The MARCH, 1933

MAR 10 1933

Heating · Piping and Air Conditioning

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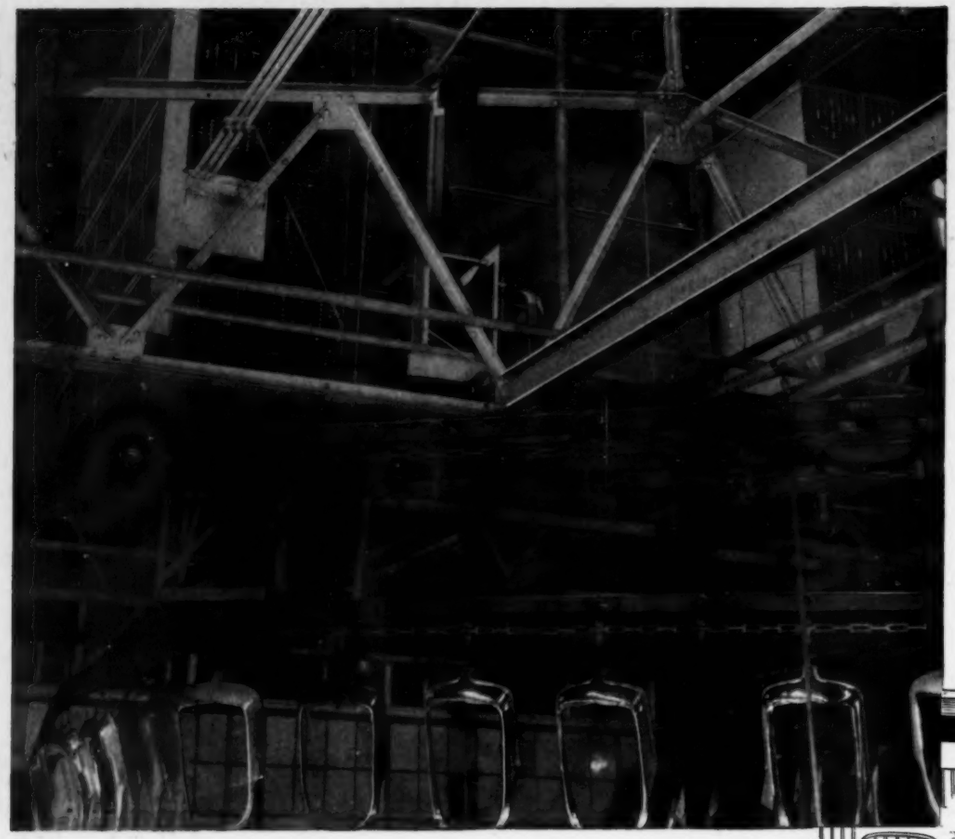
« « *and the* Journal Section *of the* American Society of Heating and Ventilating Engineers



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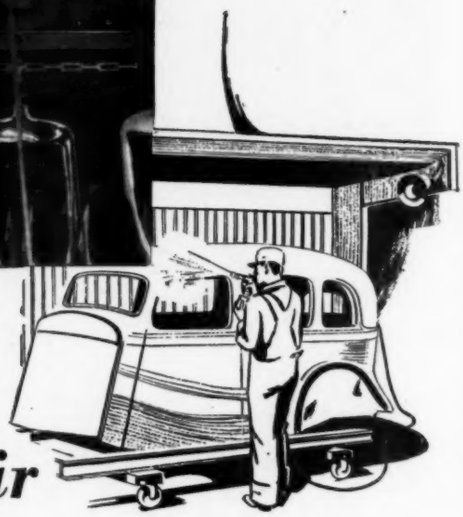

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Air supply for the spray painting booths and enamel room of the Plymouth plant in Detroit is freed from dust by the filter banks shown in the large illustration.

Dustop, the new Owens-Illinois glass wool air filter, solved a problem in the Plymouth plant in Detroit.

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THE EDITOR'S PAGE

IN the Journal Section of the A. S. H. V. E. this month is published the proceedings of that Society's recent annual meeting and the report of the A. S. H. V. E. committee on research for 1932. During 1932, this committee gave consideration to 14 different research projects, ranging all the way from studies of air infiltration and heat transmission in buildings to such subjects as sound in relation to heating and ventilating and air conditions in their relation to living comfort. Of particular interest during 1932 was the re-study of the comfort chart and comfort line, a project which has clarified the use of "comfort data" in no small measure.

Readers of this publication are fortunate in having the complete and exclusive reports of this Society's research activities come to them each month. Through its own laboratory devoted to research (the only one of its kind), by cooperative agreements with leading universities and associations, and with the sponsorship of many of the leading engineers and companies in the field, the research work of the A. S. H. V. E. offers much of value to heating, piping and air conditioning engineers.

CALL it modernization, rehabilitation, renovizing or what you will, the idea of replacing where replacements are necessary, adding where additions will improve, changing where changes will benefit and repairing where repairs will suffice appeals with increasing force to industry and commerce as a program for downing costs and upping net profits. Believing that actual examples of modernization projects containing specific information on what was done and what was accomplished would meet the present needs of our readers, we have for some months published articles of this type and in January devoted the entire issue to this theme. That this editorial program has been well-received is evidenced by numerous letters from men concerned with heating, piping, and air conditioning in industrial plants and large buildings.

Evidence of the wide interest in modernization is the "Renovize Philadelphia Campaign," which—according to reports—created $20,000,000 worth of new business in three weeks. The basic idea of the Philadelphia plan is to appeal to the *self-interest* of the individual plant, concern, or citizen to take advantage of present conditions to repair, remodel, and restore. Rehabilitation projects involving expenditures of $155,000,000 are reported by the national committee on industrial rehabilitation. That expenditures for such work result in creation of employment and business follows as a matter of course.

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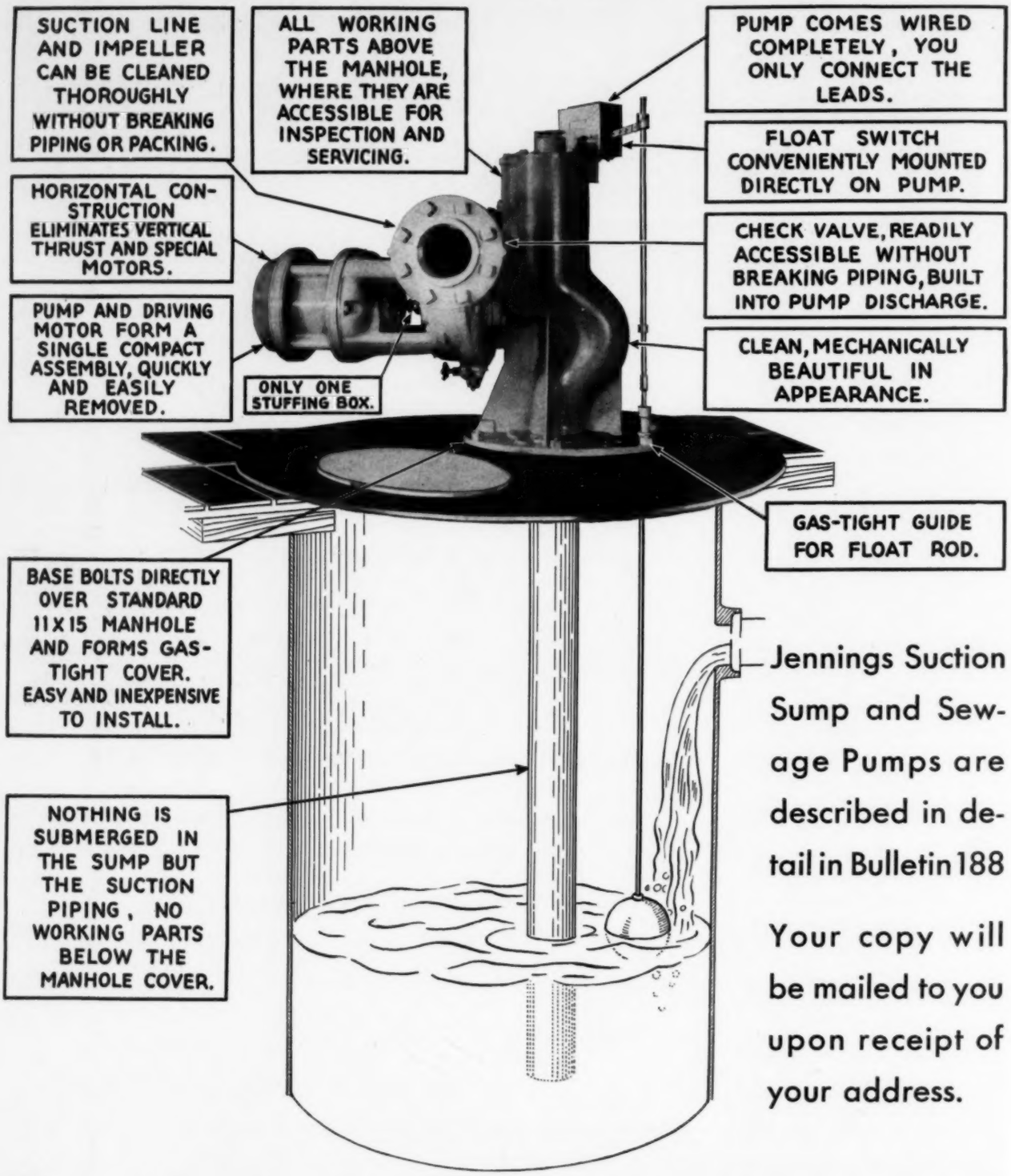
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The March, 1933

Vol. V, No. 3

Heating · Piping and Air Conditioning

UNIT-TYPE

Air-Conditioning System Modernizes

THIS LARGE DEPARTMENT STORE

Fig. 1—The Neiman-Marcus Company department store in Dallas, recently modernized with a unit-type air-conditioning system using 50 overhead-type conditioners. The entire store, save the basement which is not used for sales purposes, is cooled and dehumidified

By A. W. Moulder*

INSTALLATION of a unit-type cooling and dehumidification system to air condition the large department store of the Neiman-Marcus Company, in Dallas, Texas, was completed last summer. The store (Fig. 1) is a 4-story building 94 by 220 ft and an adjoining 2-story building 26 by 100 ft. The basement is not used for sales purposes and is the only portion not cooled. Chas. L. Kribs, Jr., of Dallas, was consulting engineer on the job.

50 Overhead-Type Units Used

The system required the installation of 50 air-conditioning units of the overhead type (illustrated in Fig. 2) suspended in strategic positions, taking into account both the necessity for uniform distribution of air as well as adaptability to practical locations.

The unit system may briefly be described as differing from a central-type system in that fluid is cooled at a central point and distributed through relatively small piping to units located in the areas where the air is to be conditioned. In the better known central system, air is conditioned at a central point and distributed through metal ducts to such areas.

Why Units Are Used

The prime reason the unit-type system was used for this installation was because of its adaptability to the store's physical requirements. The interior of this store was remodeled a few years ago, making it one of the most beautifully appointed style shops in the country. Each department is a separate display room—exquisitely finished and furnished—where the customer may select from samples the type of merchandise in which he or she is interested. The stocks of merchandise are kept in separate store rooms, work rooms or closets adjacent to the display rooms. It was of utmost importance that these display rooms—which had been so beautifully fitted up at great expense—should not be marred by installation of any duct work.

In most stores air-conditioning units of attractive appearance would not need to be concealed, but in the exquisitely-finished interior of the Neiman-Marcus store, absolutely nothing could be installed in the display rooms which did not harmonize perfectly with the finish and furnishings of the individual rooms.

All Equipment Is Concealed

The unit-type system installed lends itself to these requirements admirably. The work rooms, stock rooms and

*Manager, Heating-Power and Industrial Piping Division, Grinnell Company, Providence, R. I. Member of Board of Consulting and Contributing Editors.

closets adjacent to the display rooms form ideal locations for installation of the unit air-conditioners. The relatively small piping required for distribution of the cooled fluid to the units was easily installed in inconspicuous places with a minimum of necessary cutting and patching.

Most of the units are suspended overhead in the stock rooms, closets, etc., with a simple type of outlet transition, formed usually of fiber board; recirculation is allowed for by locating grilles near the floor and leading into the stock rooms, but usually with no connection from the return-air grille to the unit.

In the instal.ation of units in concealed spaces this latter point is of importance from the noise standpoint, because connections by ducts of relatively small size to both ends of units tend to amplify any slight noises in the unit. If, however, the unit is hung in a fairly large open chamber it may be connected at the discharge end to a grille without increasing the noise over what would be experienced with a unit installed directly in the room to be conditioned. Unit-heater practice has shown (in hundreds of practical but somewhat unusual installations) that units of good construction and with properly-designed fans and motors may have fans operating up to a 5000-f p m tip speed and still be sufficiently quiet for commercial installations or in sizable offices.

Fig 4 shows an ideal installation with the unit suspended overhead in a small stock room adjacent to one of the display rooms. A grille harmonizing in design with the furnishings of the room is located above the door for discharge of the conditioned air. The grille fitted into the bottom panel of the door allows recirculation air to enter the stock room.

Behind the wall and big oval top mirror seen in Fig. 5 is a work room. In this case a rather large recirculation chamber was partitioned off near the ceiling of the work room and the unit placed in this chamber. The illustration shows how discharge of conditioned air is made through the grille over the mirror; return air is recirculated through the lower grille at the right. Fig. 6 illustrates another case where the unit is suspended openly overhead in a closet with return air through grilles in the door.

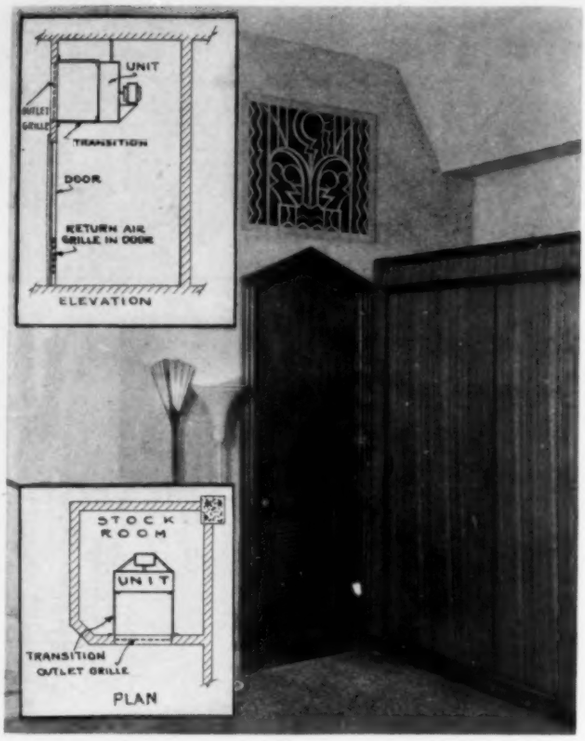
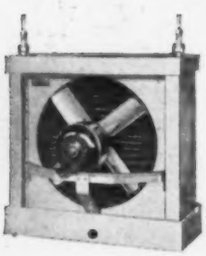


Fig. 4—Installation of one of the units suspended overhead in a stock room and supplying conditioned air to the adjacent display room



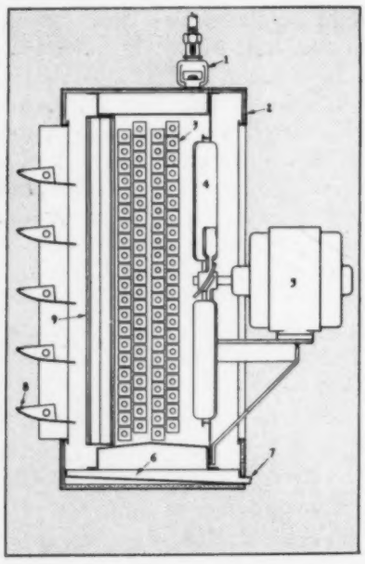


Fig. 2 (left)—Front and rear views of the unit, 50 of which condition the Neiman-Marcus store. Fig. 3 (right)—Cross-section of one of the units, showing (1) adjustable hangers, (2) copper housing insulated with cork, (3) tube and fin assembly, (4) propeller-type fan, (5) capacitor-type variable-speed motor, (6) condensate drip pan, (7) condensate drain connections, (8) louvers, and (9) moisture eliminator

Fig. 7 is an interior view of the *Hexagon Room* where fine crystal ware and silver is displayed. This room is always brilliantly lighted with 570 electric bulbs of various sizes. Under maximum cooling load conditions approximately 6 tons of refrigeration is required to offset this artificial lighting load alone. Prior to installation of the cooling system, this room could not be used at all during hot weather. Units are located in corridors adjacent to this beautiful room; discharge is through inconspicuous louvers near the ceiling, while recirculation is effected through grilles in baseboards connected to recirculating ducts.

Figs. 8 and 9 are further views to indicate the type of interiors to be coped with because this item of adaptability of unit air conditioners seems worth emphasizing, in that possibly many modernization projects may be completed with this type of system in places where building construction makes air conditioning difficult.

Only Ventilation Is Natural Air Change

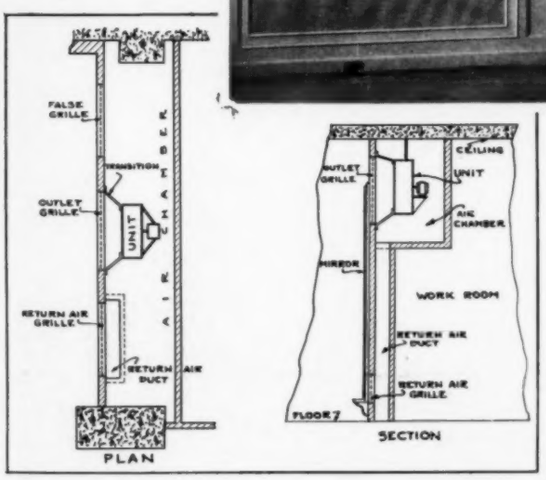
The Neiman-Marcus system is designed for recirculation of air only; in other words the only ventilation is the natural air change inherent in a building of this type.

Fig. 10 is a general view of the first floor, of particular interest because by close examination it can be

observed that the door leading outside is open. The photograph was taken on a hot day. As a matter of fact there are three sets of doors like this leading into the first story directly from the street. This recirculation type of system was operated regularly with these doors all open without noticeably affecting or impairing the efficiency of the system.

For only one room—the *Hexagon Room*—where the heavy artificial light load already described is encountered, was mechanical ventilation installed so as to assist in economically overcoming this excessively high sensible head load.

Fig. 5—Installation of conditioner in a work room behind large mirror in room conditioned. In this case a large recirculation chamber was partitioned off near the ceiling of the work room



Summary of the System's Features

Fig. 11 diagrams the general scheme of the system as installed and in which is incorporated these features:

Air-conditioning-type units with one or more units installed in each room to be conditioned.

Fluid circulation piping system carries cooled fluid to and from each unit.

Compressor equipment for cooling the fluid to proper temperature.

Fluid cooler or heat exchanger (Fig. 12 shows this apparatus).

Drain piping system from units to carry off water condensed in the process of dehumidification.

Construction of the Air-Conditioners

The units are of the copper-tube-and-fin type, *U*-tubes being used, with cast-iron side header, having supply and return fluid chambers and with propeller-type aluminum-blade fans direct-connected to capacitor-type variable speed motors. The units have heavy interior galvanized frames and are enclosed in pure copper hous-

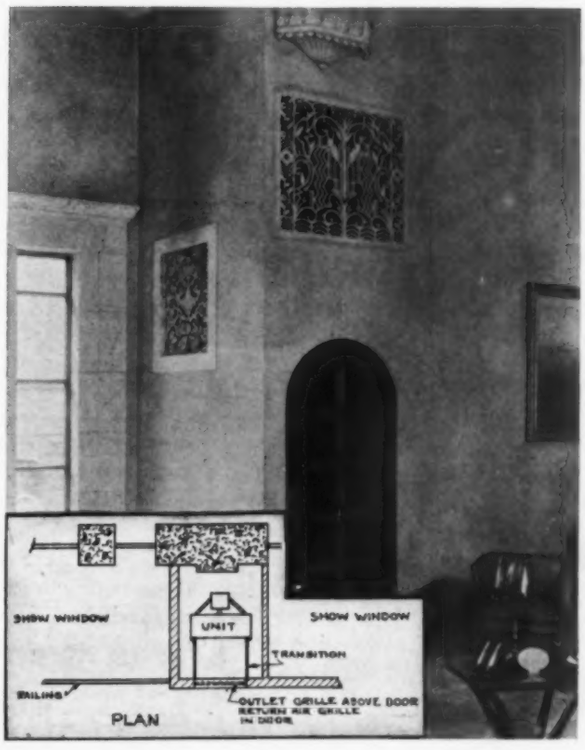


Fig. 6—Unit suspended openly overhead in closet with return air through grilles in door

Fig. 7 (left)—The beautiful "Hexagon Room" lighted always with 570 electric bulbs. Before installation of the cooling system this room could not be used in hot weather

Figs. 8 & 9 (below)—These views illustrate the type of interiors and indicate why the air conditioning equipment had to be entirely concealed

Fig. 10 (at bottom)—General view of first floor. Note that the door to the street is open, despite its being a hot day

ings cork insulated on the inner side to prevent sweating. Concealed inside of each unit is a copper drip pan for catching moisture condensed on the tubes. Between the louvers and the coils is located a series of vertical vanes to prevent the possibility of free moisture being blown off the tubes into the room. The cross section of a unit through the middle, Fig. 3, shows the interior drip pan, moisture eliminator, tubes, fan, motor, etc.

10-F Rise in Fluid Circulated

The fluid-circulating system is designed to allow for 10-F rise in fluid temperature while passing through the units, a greater rise in temperature than is customary in ordinary brine circulation systems in refrigeration work. In the interest of lower first costs with the smaller pipe sizes thus required plus lower pumping costs it was determined that this temperature rise would provide an economical design. In these calculations allowance was made for some increased refrigeration compressor capacity which might be required for the lower refrigerant temperatures for a few days of extreme conditions.

It is of interest that, for buildings of average occupancy, the 10-F rise in cooling fluid will, when using the same piping and circulating pump for hot-water heating in the winter time, result in approximately a 20-F drop in temperature through the same units.

By careful calculation of pipe sizes on a frictional resistance basis, the flow to each unit was equalized so that no throttling of valves was found necessary.

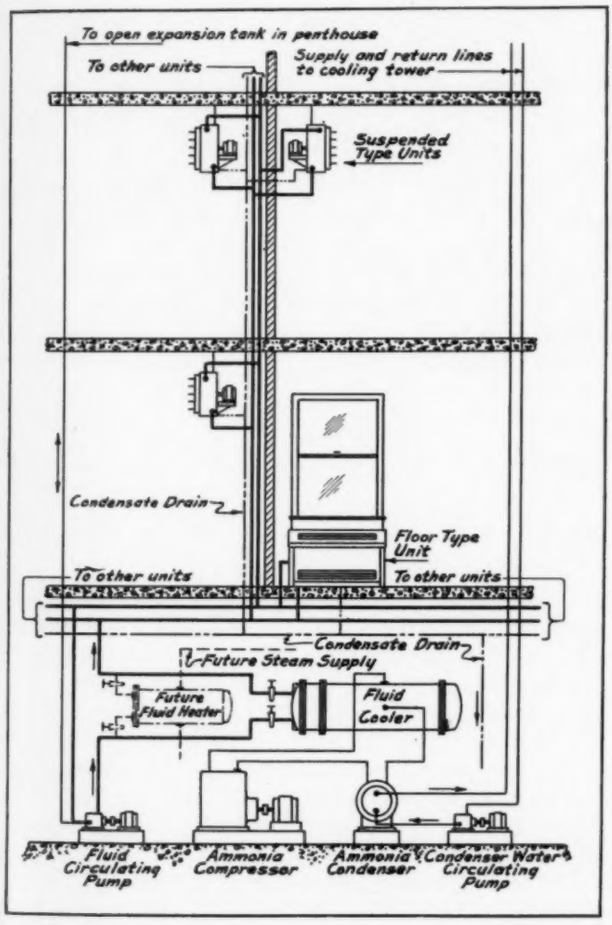
If a 10-F (or greater) rise in temperature is allowed through the units, the velocity of fluid circulation through ordinary units is relatively low. To provide a unit which will operate at high thermal transfer efficiencies at these low velocities necessitates careful and special designs. Unit capacity results plotted by tests at lesser temperature rise (and therefore higher velocities) will usually be found to be at considerable variance under the two velocity conditions unless the design of units is corrected to allow for it.

Non-Freeze Liquid Circulated

This system has been referred to as a *fluid-circulation* system rather than a water system for this reason: The system was designed and guaranteed to produce a mean temperature drop of 12 F over the conditioned areas with 100-F dry-bulb and 78-F wet-bulb outside. To produce these results the system was calculated to operate at an average fluid temperature in the units of 40 F

(45 in and 35 F out). A special non-freeze liquid is used in combination with water as the cooling medium to allow lowering the temperature to 20 F. This is done to guard against possibility of freezing in the cooler at any time and to provide some flexibility for extreme weather conditions, especially when the outside wet-bulb temperature might be unusually high. Under such conditions dehumidification can be greatly accelerated by depressing the fluid temperature. Some excess capacity is provided in the ammonia compressors to allow for such extreme conditions.

Fig. 11 — General scheme of the air-conditioning system in the Neiman-Marcus store. By circulating hot-water, the units may be used for heating in winter



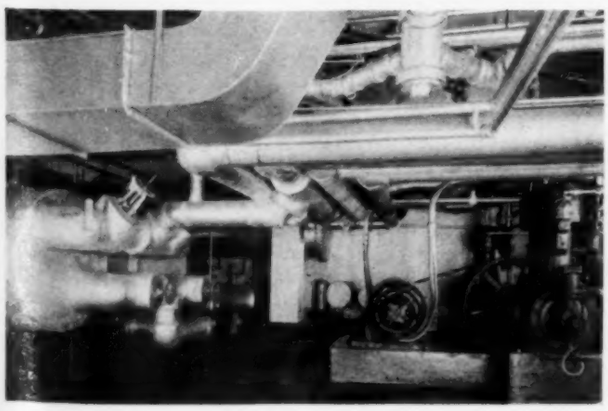


Fig. 12 — At the left are the coolers which cool the fluid circulated through the units. At the right are the ammonia compressors. Rated capacity of the refrigeration plant is 230 tons and the connected motor load is 335 hp

Table 1—Wet- and Dry-Bulb Temperatures Maintained by Unit-Type Air-Conditioning System in Neiman-Marcus Co. Store

	Department	Time—9 A. M. Outside Temp. 84° D. B.—73° W. B. Inside Temperatures				Time—3 P. M. Outside Temp. 98° D. B.—75° W. B. Inside Temperatures			
		Dry Bulb	Wet Bulb	Rel. Hum. %	% Comfort Zone	Dry Bulb	Wet Bulb	Rel. Hum. %	% Comfort Zone
First Fl.	Shoe Dept.	76	65	55	96	79	66	50	84
	Main St. Entree.	76	65	55	96	80	67	50	70
	Glove Dept.	76	64	51	98	79	66	50	84
	Men's Shop.	77	66	55	90	80	67	50	70
Second Fl.	Sports Wear	76	65	55	96	79	66	50	84
	Ladies Wear	77	66	55	90	79	66	50	84
	So. French Rm.	75	64	54	96	78	65	49	89
	Coat Dept.	78	67	56	84	79	66	50	84
	No. French Rm.	76	65	55	96	77	65	52	94
	Tailor Shop.	77	66	55	90	78	65	49	94
Third Fl.	Corset Dept.	78	66	52	86	80	67	50	72
	Younger Set Dept.	78	66	52	86	80	67	50	72
	So. French Rm.	76	65	55	96	79	66	50	84
	Hat Dept.	78	66	52	86	79	66	50	84
	No. French Rm.	78	66	52	86	78	66	52	84
Fourth Fl	Chintz Room	77	66	55	90	78	65	49	90
	New Orlns. Rm.	78	67	56	84	78	65	49	90
	Gift Shop	78	67	56	84	78	65	49	90
	Hexagon Room	76	65	55	96	77	64	48	96
	General Office	78	65	49	90	78	64	46	94
	Mr. H. Marcus' Office	78	66	52	86	78	66	52	89
	Rest Room	78	67	56	84	78	67	56	84
	Aver. Store Temp.	77	65.6	54	90	78.5	65.7	50	84.8

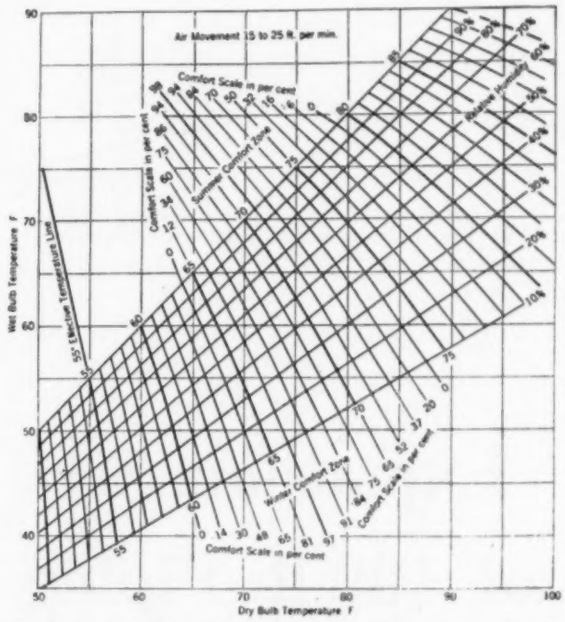

Air Movement 15 to 25 ft. per min.
Comfort Scale in per cent
Summer Comfort Zone
Winter Comfort Zone
Relative Humidity
55° Effective Temperature Line
Wet Bulb Temperature F
Dry Bulb Temperature F

Fig. 13—Comparison of Table 1 with this comfort chart* will indicate how closely the conditions maintained by the air-conditioning system approach theoretical perfection in human comfort

*Copyright, American Society of Heating and Ventilating Engineers.

Capacitor-Type Motors Give Close Control

Control of the system is partially automatic and otherwise manual. The units are furnished with capacitor-type motors having a choice of eight speeds in the capacitor boxes. Only three of these speeds may be con-

(To page 68, back Advertising Section)

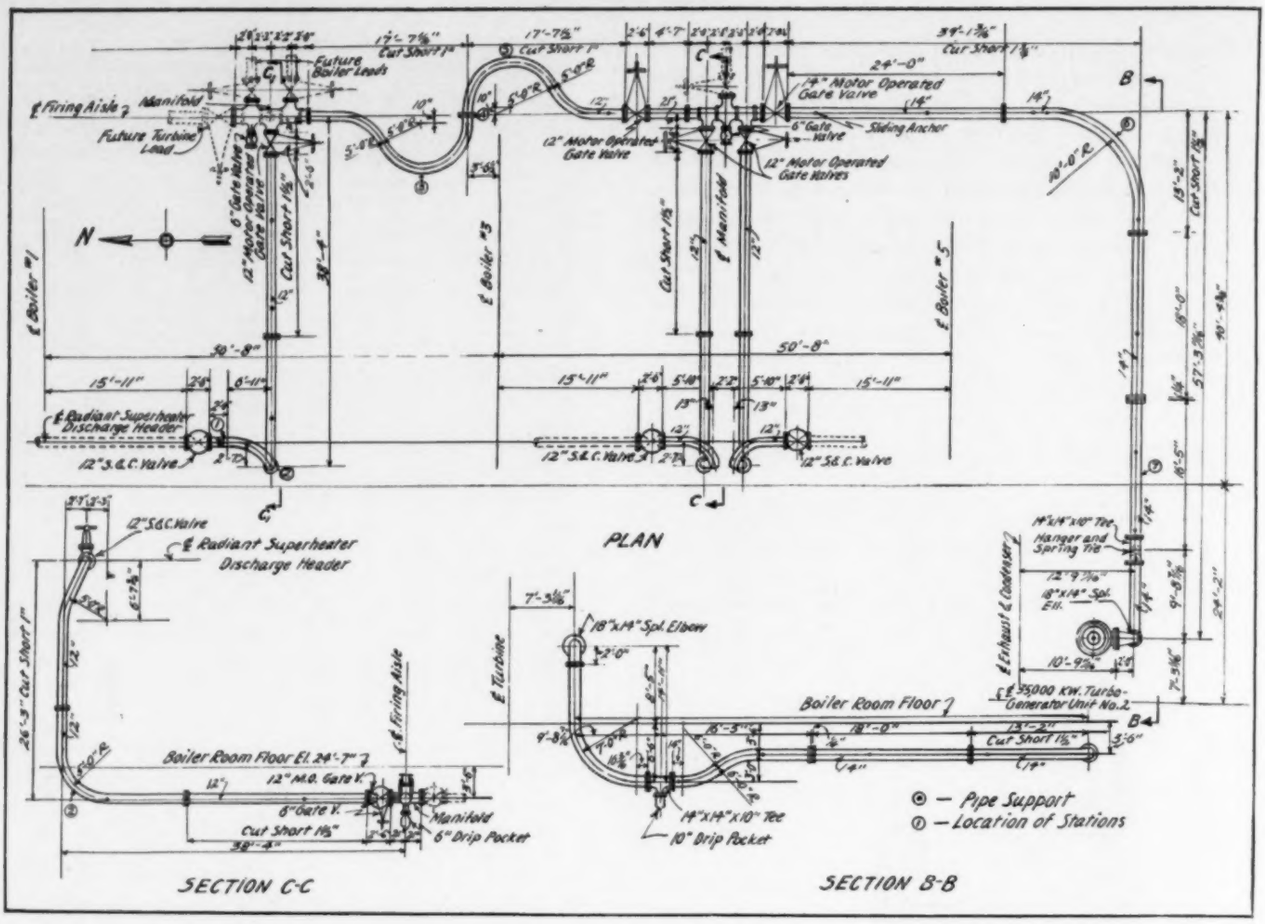


Fig. 1—Layout of the high-pressure steam piping, showing the location of the supports and the stations referred to in the tables

Expansion, Set of 400-lb Piping Are Studied

By • • • • • • **W. P. Palmer***

In this brief article, the author presents data on expansion and permanent set of steam piping, the result of an investigation made by him on an installation for 400 lb, 750 F steam. An interesting feature—also described—is a rugged support designed to take care of any piping vibration. . . . . . .

SOME interesting data have resulted from studies made on the high-pressure steam piping installed a few months ago in an existing plant. The steam pressure carried is 400 lb gage and the total temperature is 750 F.

The lines are extra heavy with cast-steel valves and fittings with Van Stone joints. Fittings are series 40. All flanges are furnished with raised faces, phonograph finish, with 1/16-in. thick gaskets.

The high-pressure steam piping is designed to use manifolds. These steel manifolds are just long enough to receive the various connections and are so located that each manifold ultimately will have three boiler leads, one auxiliary steam, one supply to the turbine and one cross-over connection to the other manifold. Motor-operated gate valves are installed on the boiler leads, steam supply lines to the turbine, and the cross-over connections. In each case the manifolds are anchored and the expansion is partially taken care of by pipe bends. All pipe bends were designed with a minimum radius of five pipe diameters. In cases where the pipe bends were not sufficient to take care of the expected expansion, the piping was cut short to make up the difference. It was calculated that the expansion in the pipe would be approximately 6.4 in. per 100 ft

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Table 1—Readings Indicating Movement of Piping with Steam at 700 F. (See Fig. 1)

Case A. No. 1 boiler in service.
Case B. Nos. 1 and 3 boilers in service.
Case C. Nos. 1, 3 and 5 boilers in service.

Station	Direction of Travel	Travel in Inches		
		Case A	Case B	Case C
No. 1	Up	0		0.13
	South	1.00	1.00	1.00
	West	0.31	0.31	0.13
No. 2	Down	0.88	0.75	1.06
	South	0.63	0.75	0.50
	West	1.94	1.69	1.81
No. 3	Up	0.06	0.06	0.06
	South	0.88	0.88	0.91
	West	0.81	0.88	0.88
No. 4	Up	0.06	0.06	0.06
	North	0	0.13	0.13
	East	0.69	0.31	0.31
No. 5	Up	0.06	0	0
	North	0.69	0.78	0.81
	East	1.25	1.25	1.28
No. 6	Up	0.13	0.13	Not
	South	2.84	2.94	taken
	East	2.25	2.00	
No. 7	Down	0.09	0.15	Not
	South	1.25	1.25	taken
	East	0.47	0.69	

Table 2—Readings Indicating Permanent Set of the Piping (See Fig. 1)

X. Initial zero readings prior to start up.
Y. Zero readings, no boilers in service.
Z. Zero readings with Nos. 3 and 5 boilers in service and sectionalizing valve closed. No. 1 boiler out of service.

Station	Direction of Point From Reference Angle	Measurement in Inches		
		X	Y	Z
No. 1	Up	9.50		9.50
	North	0.88		0.75
	West	2.94		2.88
No. 2	Down	1.69	1.69	2.00
	North	1.50	1.56	1.23
	East	0.94	1.00	1.13
No. 3	Down	6.06	6.00	6.00
	North	3.22	2.94	2.88
	East	2.06	1.88	1.94
No. 4	Down	1.69	1.69	1.63
	North	2.50	2.31	2.63
	East	1.94	1.88	2.00
No. 5	Down	4.31	4.31	4.38
	North	1.66	1.56	2.13
	East	0.13	0.06	0.50
No. 6	Down	0.19	0.25	Header not
	North	8.69	8.63	out to
	East	2.25	1.31	this point
No. 7	Down	1.66	1.41	
	North	4.69	4.75	
	East	1.53	1.47	

of length. The amount cut short varied from one to 1¾ in.

Means Provided for Studying Expansion

When the piping was designed means were provided to obtain data on the expansion of the main steam piping. At certain locations (see Fig. 1) ⅜-in. nuts were spot welded to the pipe and tramming points screwed into these nuts. Measurements were taken between the ends of these points and angles spot welded to the building steel. Initial zero readings were taken prior to starting up. The readings shown in Table 1 indicate the movement as determined by measurements from this original zero with a steam temperature of approximately 700 F.

The movement of the piping at the points selected checks very closely with the design calculations.

Data on Permanent Set

Another interesting feature on the expansion of this steam piping are the data collected on the permanent set of the piping, indicated by the readings shown in Table 2 taken when the header was cold.

From Table 2, it will be noted that the maximum set for any location was about ½ in. which occurred at station 5 under the *Z* condition, that is with boiler *No. 1* out of service and the sectionalizing valve closed. However, in considering the *Z* condition, a glance at Fig. 1 shows that the sectionalizing valve is connected to the manifold, which is anchored, by a filler piece 4 ft-7 in. long. Therefore, the expansion on the filler piece plus the gate valve will influence the location of stations Nos. 5, 4, and 3. Correcting for the 7 ft-0 in. in length for the above valve and pipe for station 5, the result checks very closely the reading taken under condition *Y*. From the above, it appears that the permanent set is shown more correctly under condition *Y*.

Rugged Support Takes Care of Any Vibration

Another interesting feature is the design of the supports for the high-pressure steam piping. It will be noted from Fig. 2 that the structural members are of

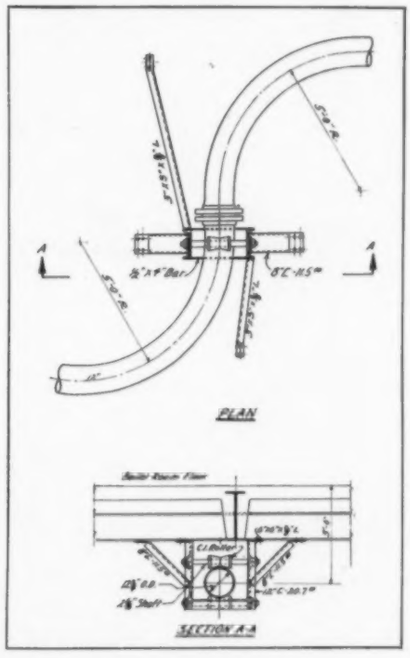

Fig. 2—Typical roller support for the high-pressure steam piping

sufficient size to support a much heavier load than that imposed by the pipe, thus insuring a very rugged stiff support to take care of any vibration in the piping. In case of a rupture or break in the pipe, the vertical 12-in. channels will tend to keep the pipe in position and minimize the damage to adjacent equipment.

This equipment has been in operation about fifteen months and to date there has been no gasket failure or

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Meeting Special Heating Needs When Main Plant is Shut Down

Often it's necessary to supply heat to some parts of a building when most of the system can be shut down. This article tells how a greenhouse in one building and laboratories in another building of a university group heated by central-station steam are kept at constant temperature when the steam from the central plant is shut off.

In the first case hot water heated in a converter is circulated; central-plant steam heats the water normally and an auxiliary hot-water boiler takes over the job when steam is not available. In the second instance, an auxiliary oil-fired boiler does the work.

By • • • **H. H. Angus***

IN some buildings it is necessary to supply heat to certain parts at all times even though most of the system can be shut down. Frequently this may be done by running separate mains from the boiler room. In garages for example heat is required in the office in the spring and fall while the garage itself may not need to be heated to be sufficiently warm for manual work. For this purpose the valves controlling the main system are closed and all steam passes through the auxiliary mains, saving shutting off the radiators in the garage and considerable loss of heat in the main piping.

Often the problem is more complicated; this article deals with two buildings at Toronto university on heating systems designed by the author. This group of some forty buildings is heated by low-pressure steam from a central plant. It has been found by experience to be economical and is now the custom to shut off steam from the mains at the heating plant for considerable periods at night, depending upon the outside temperature. This is satisfactory except in a few special buildings, of which the following are typical.

Hot-Water Converter, Auxiliary Boiler Used

A few years ago a botany building with a good-sized greenhouse was added to this group; it is necessary to keep the greenhouse at a uniform temperature as it is used for experimental work. There are also living quarters in the classroom section for the man in charge of the greenhouse.

These two spaces are heated when the rest of the system is shut down in the following manner (Fig. 1): Both greenhouse and apartment are on a separate system and are heated by hot water circulated by centrifugal pumps. The water is heated by a converter, steam being supplied the converter from the central plant through the steam mains under ordinary conditions. There is also an auxiliary hot-water boiler of capacity to heat the greenhouse connected to the piping so that normally it is in series with the converter, but either it or the converter can be operated individually. The boiler has an automatic oil burner controlled by a thermostat in the greenhouse.

Under normal conditions the water is heated in the converter and passed through the hot-water boiler, keeping the boiler warm. The temperature is controlled by a thermostat on the converter which can be set manually to keep the water at any desired temperature to suit outside conditions. At night when the steam is shut off the system at the central plant, the temperature in the rooms drops slightly and the thermostat-controlled oil burner goes into action. As the water in the boiler is at the same temperature as the rest of the system the oil burner heats up the water immediately and keeps the greenhouse temperature within narrow limits. A bell in the living quarters summons the building caretaker if the oil burner does not function properly.

Auxiliary Steam Boiler Heats Laboratories

In the hygiene building (where experiments requiring constant room temperatures are carried on) a similar

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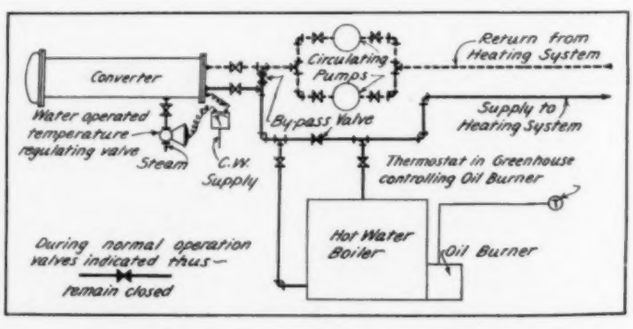


Fig. 1—How a greenhouse and apartment in a building heated with steam from a central plant are heated with hot water circulated by centrifugal pumps when the main plant is shut down. Under normal conditions the water is heated in the converter by central-plant steam; when the steam is shut off the auxiliary boiler automatically takes on the job

*Consulting Engineer, Toronto, Canada.

Thaws Rink Ice *at* Saving *of* $116 *and* 42 Hours

By Erwin L. Weber*

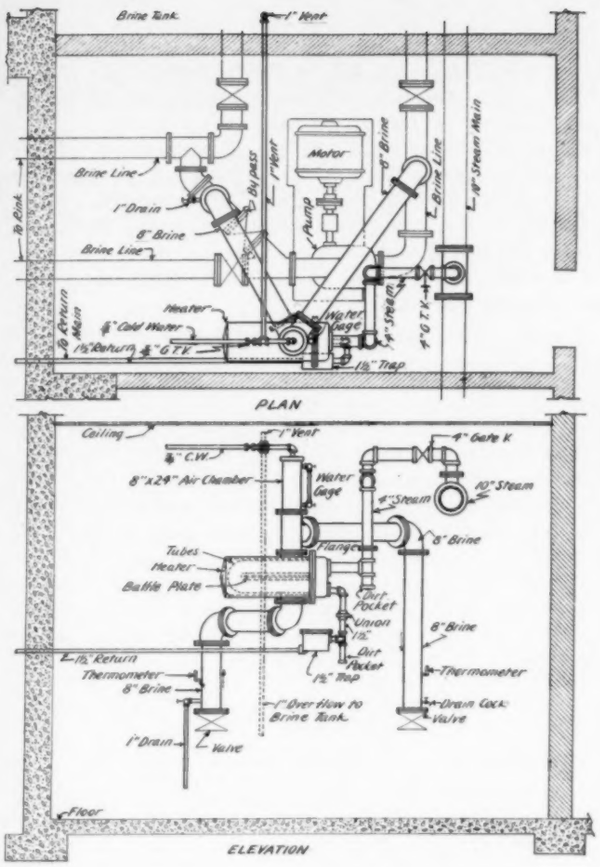


Fig. 1—Plan and elevation of the brine heating equipment for thawing ice from a skating rink. As little data are available on the heat transfer rates which must be known in laying out such a system, this article will prove of special value to engineers confronted with a similar problem to solve

TO reduce the time required for and the cost of ice removal, it was decided last year to install an ice-thawing system in the Seattle civic arena. This arena is converted into an ice rink during the winter and is used for hockey games and other ice sports. During the balance of the year, it is used for miscellaneous civic events, conventions, boxing and wrestling matches, horse shows, etc.

Previously it had been the custom at the end of the hockey season to remove the ice by scraping it off with a tractor-drawn scraper and melting the last of the ice by using the heating and ventilating system. Under average conditions, this took 48 hours and used 33 tons of coal costing $127.00. It also required the services of five men.

After the ice was melted, the rink was covered with earth and planking laid over the fill. It always took a full week to complete this change-over and for a considerable length of time thereafter the floor of the arena was uncomfortably cold. Nearly every year the arena could have been rented for from one to three days at $150.00 per diem during this period, but because of the time needed to remove the ice, this income had to be forfeited.

The rink is 195 ft long and 80 ft wide and has 227 lines of 1¼-in. brine pipes running its full length. These rest on sleepers and a sand bed. The lines are provided with a quarter bend at each end and are welded into a 10-in. flow and a 10-in. return header. Brine is circulated through the lines by an 8-in. centrifugal pump from the brine tank. The refrigerating plant is of 75 tons capacity. At the end of the season the ice has a thickness of about 4 in. and a temperature of about 26 F.

Steam supply at 10-lb pressure is available from two 200-hp boilers.

How Ice-Thawing Piping Was Designed

The author was commissioned to design ice-thawing equipment. As there were no definite data available on the rate of transmission from the warm brine coils to the surrounding ice mass, it was estimated that this rate would be about 15 Btu per sq ft per degree difference in temperature per hr.

It was deemed advisable to limit the temperature of the brine to 55 F to avoid buckling of the 195-ft lengths of parallel pipes.

A steel shell heater with copper steam coils and a baffle plate was used and connected on the counter-current principle. The rate of transmission from the steam to the brine was estimated at 400 Btu per sq ft per degree difference in temperature per hr. A heater with 70 sq ft of heating surface was estimated to be of sufficient size to supply all the heat to the brine which could be dissipated by the brine coils with the pump delivering 1,200 gpm.

With these assumptions it was estimated that the ice could be removed in about nine hours following the last hockey game (between 11:00 p. m. and 8:00 a. m.) so that a crew of workmen could start the following morn-

*Consulting Engineer, Seattle, Wash.

ing to place the fill and flooring. The fuel consumption was estimated at less than five tons of coal, using one boiler only.

Fig. 1 shows the installation. The cold water line and drains are provided to enable thorough cleaning and removal of brine from the heater and connections. The air chamber and vent line with overflow to brine tank are for air relief.

Last spring, when the plant was first operated, workmen began to scrape away the top surface of the ice and the plant was started at 11:00 p. m. In less than two hours the ice was so soft that it could no longer bear the weight of the tractor and scraping had to be discontinued. The scraper will not be used again in the future.

The ice was all melted at the end of six hours and the fuel consumption was three tons of coal costing $11.00.

Calculations Show Heat Transfer Rates

The following calculations may prove of value to others confronted with a similar problem.

Size of rink, 195 ft by 80 ft = 15,600 sq ft.

Thickness of ice, 4 in. = 5200 cu ft at 57.5 lb per cu ft = 300,000 lb or 150 tons.

About 20 per cent of the ice was scraped away, leaving 120 tons removed by melting.

Temperature of ice, 26 F.

Heat required to melt the ice, 300,000 × 120 = 36,000,000 Btu.

There are 227 lines each 195 ft long, or about 45,000 ft of 1¼-in. pipe containing approximately 30,000 lb of brine, which together with the contents of the brine tank, etc., gives a total of about 50,000 lb of brine.

This was raised from 26 F to 56 F or 30 F, requiring a total of about 1,500,000 Btu. Hence the total heat load was 37,500,000 Btu.

The thawing time was 6 hours, giving 6,250,000 Btu per hr. 6000 lb of coal was consumed, or 1000 lb per hr.

The available heat was 6250 Btu per lb of coal, showing an overall efficiency of about 55 per cent.

The pump delivered about 1200 gallons, or 10,000 lb, of brine per minute, making the total brine circulated in six hours 360 × 10,000 or 3,600,000 lb.

This gives an average drop in temperature of brine of 37,500,000 ÷ 3,600,000 or 10.4 degrees.

The maximum temperature of brine was 55 F, giving an average temperature of about 50 F.

The pipe surface (45,000 ft of 1¼-in. pipe) is about 19,000 sq ft.

As the average brine temperature was about 50 F and the melting ice temperature 32 F, there was a difference of 50-32 or 18 degrees between the melting ice and brine. This gives a transmission rate of (6,250,000) ÷ (18 × 19,500) or 17.8 Btu per sq ft of pipe per degree difference in temperature per hr.

The heater has a heating surface of 70 sq ft of copper pipe. The steam pressure was 10 lb with a corresponding temperature of 238 F.

The difference in temperature between steam and brine was 238 — 50 or 188 F. This gives a transmission rate of (6,250,000) ÷ (70 × 188) or 475 Btu per sq ft of heater surface per degree difference in temperature per hr.

Fuel Cost Cut $116

The plant proved very satisfactory and showed a better performance than was anticipated. It reduced the cost of fuel for ice removal from $127.00 to $11.00 (a saving of $116.00) and eliminated the services of five men, a tractor and scraper. The thawing time was reduced from 48 to 6 hours, permitting the arena to be used four days sooner. It also eliminated the cold floor previously encountered during a prolonged period after the ice had been removed, due to the heating effect of the warmed brine.

Practical Notes on Pipe Welding

By **Arthur E. Christen***

MUCH has been written on piping systems in general, but too little about welded piping. The article in the August 1932 issue, describing the welded piping system for the heating of the new Field building in Chicago, was therefore timely, and brought out a number of points which were doubtless entirely new thoughts for consideration in piping systems to many concerned.

Rolling of Pipe Being Welded

The article suggests that a vital problem in the welding of larger pipe is rolling. The experienced user of welded piping may well explain that the statement is but partially correct, since under all conditions it will not apply. Let us assume a pipe joint being welded after two lengths are properly cradled and aligned in the welding shop, and as an alternative, the same two lengths being welded after they are hung in adjustable hangers suspended from a ceiling. In the first case the roll-weld is made, not only in less time but with greater accuracy, since the pipe cradles maintain alignment throughout the operation. In the alternative case, it is reasonable to assume that the pipe hanger loops are larger—in most cases to permit insulating the pipe—and the hanger rods are rarely rigid enough to eliminate sway in the hangers. Thus we have an assembly which can be easily pulled out of shape and alignment during the rolling of the pipe to keep pace with the speed of the welding operation.

The latter case is rarely practiced, since the economy of the one method over the other has been the guiding factor, and, when it becomes necessary to make a field weld of this nature, invariably and almost without exception, the joint is welded in position without turning, thus maintaining alignment. (*Editor's Note*: In the article which is discussed here, "rolling" refers to the piping being forced out of alignment; not to rolling the pipe to aid welding.)

(*To page 72, back Advertising Section*)

*Consulting Engineer, Toledo, Ohio.

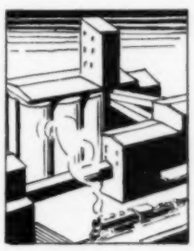
Cooling Water for Industrial Uses With Steam-Ejector Refrigeration

By **Walter L. Fleisher***

IN MY article last month, the method of cooling water for air conditioning and industrial process uses with steam-ejector refrigeration was described in detail and the operation of a typical system was diagrammed and discussed. The applications and features of this type of refrigeration are considered this month and actual examples which come to mind serve to illustrate the possibilities of steam-ejector refrigeration as a source of cool water, an essential commodity in many a manufacturing process and also necessary in connection with industrial air conditioning.

Cool Water for Process Influences Plant Location

A source of cheap, cool water for process is often the basic factor in the determination of a proper location for an industrial plant. Some years ago one of the large chemical companies was searching for a site for a new plant. In the operation of the process very large quantities of 50-F water are essential, and in consequence, it was necessary to locate the plant far from the source of raw materials, because at the particular spot selected there were several springs of capacity to provide water close to the temperature necessary to produce the product. The raw materials had to be shipped to this plant, and when they had been manufactured into a finished product, they had to be shipped back almost to the origin of the raw materials.



Estimating Cost of Cool Water

Fifty-degree water is an ideal operating temperature for the steam-ejector vacuum refrigerating cycle. With 100-lb steam pressure and 28 in. of vacuum in the condenser, a ton of refrigerating effect can be produced for 23 lb of steam per hr. (See curves published last month). Assuming that the water which is to be cooled to 50 F enters at 70 F, 72 gallons of water per hour can be cooled the 20 F for each ton of refrigeration. For each ton of refrigeration about 3 gallons of 70-F condenser water would be required. As the supply of ordinary raw water in an industrial plant is usually ample and cheap, it can be figured as costing only 2c per 1000 gallons. Therefore, if 3 gallons of *condenser water* is required per ton of refrigeration, 72 gallons of *cold water* can be obtained per hour for 0.36c for water, and (at 27c per 1000 lb) 0.62c for steam. In other words, in this particular case it would cost about 0.98c to cool 72 gallons of water per hour from 70 to 50 F. Assuming 1000 gpm of cold water required, the 800 tons of refrigerating effect to produce it at a cost of 0.98c per ton would cost $7.84 per hour.

Refrigeration Saves Freight Charges

Assume—in this particular plant—that 10,000 lb of finished material could be produced per day which would require shipping to the plant of possibly 20,000 lb of raw material, and shipping from the plant about 10,000 lb. There would be a freight charge of possibly $75.00 a day. The cost of operating the refrigerating system to produce cool water would run $188.00 a day, as against $75.00 in freight, but the $188.00 a day refrigeration cost would drop from this maximum with the winter drop in temperature of the river water until, at the end of six months, the cost would be zero. In other words, we really only have to figure—over a period of a year—¼ of the $188.00, or about $47.00 a day, as against the $75.00 a day for freight for 300 days, or $22,500 annually for freight as against $14,100 for refrigeration.

This example does not take into consideration interest and depreciation on the original investment, but indicates the economy of steam-jet refrigeration for supplying process water at this temperature. Each specific case would have to be worked in detail.

Locating Equipment at Point of Cool Water Use

In another industrial installation with which I am familiar it is essential to have water at approximately 50 F in one of the buildings of a widely-scattered plant. To obtain this water it is necessary to use refrigeration; by using steam-ejector refrigeration the entire refrigerating plant can be installed in the building in which the cold water is required, cutting the initial cost of the installation and eliminating tunnels, piping and the loss due to heat transmission incident to piping the cold process water 400 or 500 ft.

In this particular plant, condenser water is no problem, as a river flows through the property with ample water available always at from 75 to 80 F.

The fact that steam-ejector units can be placed anywhere, and preferably in proximity to the point of use of the cold water, is one of the important factors in its

*Consulting Engineer, New York City. Member of Board of Consulting and Contributing Editors.

practicability for industrial purposes. There is hardly an industrial plant in which adequate steam supply is not available in every building; water for condenser purposes is usually available, because where large amounts of cold water must be used for industrial processes the same water can usually be used for condenser purposes after it has fulfilled its function as a cooling medium.

Cool Water Needed to Maintain Production

In another case that comes to mind, a product is in a hot liquid state during the process of manufacture. This product in this state is poured over cold rollers; the rollers are cooled by water from a lake. The summer production falls off due to the high temperature of the available water. Not only does the quantity decrease, but there is also a marked difference in the quality of the goods. This is probably due to the fact that the basic elements of the product are fatty acids, and temperature has a marked influence—if not on the quality, at least on its superficial appearance.

This company has been interested in the possibility of refrigeration for this department for some time; by installing steam-ejector refrigeration in the buildings in which these rollers are placed, and using the condenser water in some of the other processes, this production problem could be solved.

Steam-Jet Units for Industrial Air Conditioning

In still another industry air conditioning is needed for the comfort of the workers. Establishing comfortable atmospheric conditions is essential due to the high relative humidities necessary in the manufacture of the product and its subsequent processing. Unless the dry bulb temperatures are artificially maintained at a fairly low point, the conditions required for the proper working of the goods creates conditions so unfavorable to the operators as to slow down the work to a point where it is noticeable in the production schedule. This industry is a fertile field for steam-ejector refrigeration. Very exact studies of the conditions to be obtained, of the basic requirements, of the type of apparatus to use and the methods of employing both the steam and condenser water are essential to a satisfactory development.

Steam for Cooling Aids Boiler Load

Another interesting point in connection with this type of refrigeration in industry is that the necessity for refrigeration occurs usually at the time when the least amount of steam is required for other purposes. As most of the boiler plants of industrial establishments are designed for maximum efficiency at loads well above the average, the increased use of steam during the low-load period tends to economy in fuel consumption in that the efficiency of the boiler is increased proportionately to the load.

Steam-Ejector Refrigeration Not New

Steam-ejector refrigeration has been used in the oil fields for at least fifteen years for some of the processes of fractionalization. Actually there are no entirely new parts in this method of refrigeration, and the entire equipment consists of the assembly of well-known and long tried out parts. Nozzles of the type used in vacuum refrigeration have been developed for at least thirty years in the turbine field. Venturi tubes, which form the thermal compressor of this system, have been used equally as long in the measurement of flow of liquids and gases, and surface and barometric condensers date back even further. Even if it were necessary to make any changes in a large installation, these changes would not involve foundations, heavy parts, permanent shutting down of equipment or anything of that sort. It might be necessary to re-adjust a nozzle or to substitute other nozzles for those installed, but anything more serious than this can hardly be contemplated. The largest individual part of this system is the condenser or condensers, as the case may be, and these have been thoroughly tested over many years.

Limitations of Steam-Jet System

In surveying refrigeration, one finds many industries requiring it that are not logical users of the steam-ejector type. Consider the bakery field. Every bakery can use refrigeration with profit, but the average bakery needs only five tons and many of the larger bakeries only between ten and twelve tons. This refrigeration

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Brief Summary of Features of Steam-Jet Refrigeration

Steam-ejector refrigeration is a simple compression cycle in which water vapor is the refrigerant.

Water vapor at a temperature above 212 F is the commonly-accepted idea of steam. Water vapor or steam at temperatures around the freezing point, though not a new conception, has been overlooked or forgotten until the demand for water at higher temperature arose through air conditioning.

The basic theory of steam-ejector refrigeration is the theory of heat interchange, and the change of heat into kinetic energy to perform work to produce the compression essential.

The ratio of compression in steam-ejector refrigeration plays as an important a part in its economy as in any other compression cycle.

Ejectors have been developed further for steam pressures of 50 to 100 lb and over, than they have for pressures below 15 lb.

The condenser pressure not only affects the economy of the system, but also the quantity of condenser water required for condensation. The possibility of condensing at higher temperatures than is feasible with an artificial refrigerant makes the ejector system valuable for warm climates.

The greatest field for usefulness of the ejector system is where condenser water can be obtained cheaply in large quantities.

The economy of such a system in the larger sizes opens new fields in those industries which could use refrigeration advantageously in their processing.

This type of refrigeration is ready for use at any time that it is required, so long as water and steam are available.

Although this refrigeration is capable of wide application, economically its application is not universal in the air conditioning and industrial refrigeration fields.

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Forget Expansion; Trouble Results

By **Bernard Kramer***

Nozzle on Gas Cooler Cracks

EXPANSION of piping is provided for by one means or another in most layouts but occasionally it may be overlooked. Two cases that have come within my own experience which gave trouble are described in the following paragraphs; each of these layouts involve a number of tanks standing side by side, the tanks being connected to a common header.

The difficulty experienced with these two jobs recalls to mind the title of a recent article in HEATING, PIPING AND AIR CONDITIONING; it ran something like this: "Plants Pay for Proper Piping Whether They Have It or Not!" One might add to this that for the plant not having proper piping, the price is higher in the long run.

Five gas coolers are connected to a common 48 in. and 36 in. gas inlet header (Fig. 1). The oval-shaped vertical steel tanks are 7′-6″ by 29′-2″ by 27′-9″ high, filled with nests of 3-in. steel tubes (1,860 tubes each 22 ft long) through which cooling water circulates. The hot gases pass around the nests of tubes in a tortuous, baffled path and are cooled from 175 to 85 F. The temperature of the gas in the inlet header is never more than 200 F. The gas inlet nozzle on each cooler is cast iron flanged, 36 in. diameter, *A. G. A.* standard for low-pressure gas. (The "36 in." refers to the end of the nozzle adjoining the header. The other end is flared to a rectangular saddle type and riveted to the gas inlet side of the cooler).

The cooler tanks are spaced 12′-6″ center-to-center. The pipe and fittings making up the inlet header are cast iron flanged, *A. G. A.* low-pressure standard. There is a vacuum of 10 in. of water in the line.

The nozzle on one of the end coolers cracked near the round 36 in. flange about four months after the coolers were put in operation. Examination indicated that this particular nozzle was probably not riveted on to the cooler shell as perfectly square as were the others; this might have aggravated the strains resulting from heat expansion. Needless to say such an examination of a distorted, broken nozzle is anything but conclusive.

To eliminate the cause of the trouble and prevent its recurrence in this or in any of the remaining coolers, a ring 1 in. wide was cut out from the header pipe about halfway between each two adjacent tanks. The gaps thus formed were covered by standard short cast-iron bell sleeves and caulked with hemp and lead wool. As the operation of the coolers is practically continuous there is no danger of the joints working loose from repeated expansion and contraction.

In a new installation this procedure would be unnecessary. Bell-and-spigot joints could be used if the header were of cast iron. With steel pipe some sort of flexible joint could be used; or one end could be made a bell with the adjacent section shaped like a standard spigot end. The writer knows of cases where both of these methods were used successfully. For smaller sized and higher pressure lines a slip expansion joint could be used.

Nozzle on Gas Reheater Snaps Off

The methods employed or suggested above would be inapplicable to the case of four gas reheaters connected to a common 8-in. steam header. These reheaters have nothing in common with the coolers described above and are not in the same plant. Vertical, circular shaped steel tanks 7′-3″ in diameter by about 17′ high these reheaters have their middle portions filled with 5-in. steel tubes through which the gas passes upward from

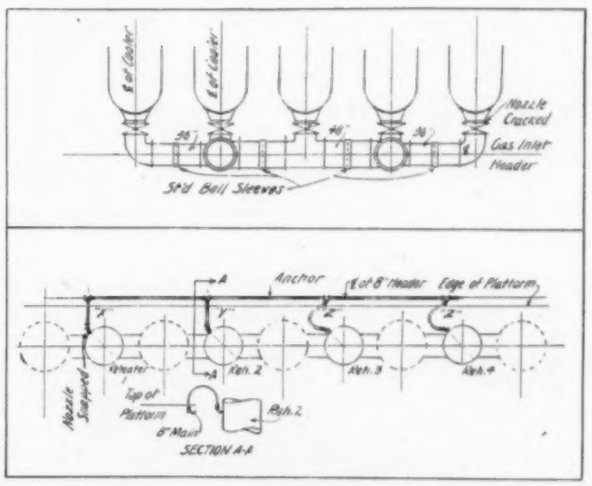


Fig. 1 (above)—After the nozzle to one of the gas coolers cracked, the header was made flexible by cutting it in four places and covering the gaps with flexible bell sleeves, caulked with hemp and lead wool. A new installation of this kind could be given flexibility by making some of the joints bell and spigot

Fig. 2 (below)—Four "stiff" branches from an 8-in. steam header were made flexible by using pipe bends. A better job could have been done by changing the location of the header at the time of installation

*Mechanical Engineer, Pittsburgh, Pa.

the lower, gas inlet section to the upper, gas outlet section. The steam for heating the gas enters through a 4-in. cast-iron flanged saddle-type nozzle riveted on the central or middle portion of the reheater tank. The condensation drains to a steam trap. The steam pressure was maintained at 15 lb gage.

While not nearly as heavy or massive as the cooler tanks previously described, the reheaters were connected by means of large sized gas piping to adjacent tanks and to the gas outlet header. This explains why the expansive force of the steam header could not move or budge the reheater tanks. The piping arrangement was as shown in Fig. 2 at point *X* when the 4-in. nozzle on one of the end tanks snapped off. It should be noted that the reheaters and other tanks shown in Fig. 2 were located in front of a reinforced concrete platform, and that the 8-in. steam header was supported from the structural steel framework supporting the platform. If it were not for this condition the best arrangement would have been to join the header to the reheater inlets by means of U-bends as shown at point *Y* and section *A-A*, Fig. 2. With the steam header anchored between reheaters *2* and *3* the two ends of the main could expand in the direction of reheaters *1* and *4*, swiveling on the screwed or Vanstone flanges of the U-bends and causing almost no strain at all on the nozzles of either the reheater or the steam header.

In the circumstances however such an arrangement was out of the question, and the piping was changed to make all the four 4-in. branches as shown at points *Z*, figuring on the expansion to be taken up by the horizontal bend. The damaged nozzle was replaced by one made of cast steel.

Taking up expansion in pipes by long radius bends is good practice in many cases. Here, however, the piping at point *Z*, Fig. 2, was somewhat clumsy. It was a patched-up job and it looked it, every bit. Had the piping been planned more carefully at the original installation a more satisfactory way could have been worked out.

Efficiency of an Underground Steam Line

By **William S. McLeish***

IN 1931, an underground steam distribution system was installed at the new State Teachers Normal School, Ewing Township, N. J. (near Trenton where the school was formerly located and where part of the old institution is still temporarily maintained.) The new school consists of several large artistically designed buildings, in an attractive setting of woods and lakes. All buildings are supplied with steam from a new power house at high pressure, reduced to low pressure inside the basements, provision being made at manholes for service connection to future buildings. The initial steam pipe size is 10-in.

The present distribution system consists of about 1900 ft of mains housed in tile conduit with waterproofed fibrous insulation. After going through one heating season of satisfactory operation, the state engineers tested a typical section to determine the thermal efficiency of the insulation, 90 per cent efficiency having been guaranteed.

The line was allowed to remain under pressure of 50 lb for six days prior to test to attain uniform conditions; the four-hour test was made July 6, 1932. The section tested consists of 580.5 lineal feet of 10-in. main, 48 feet of which is in manholes.

This test section was isolated and kept full of steam; condensation was removed periodically from the low end, carefully weighed and the average amount per hour determined. The test section was then considered as being under the same steam condition but uninsulated in still air and its heat loss calculated from L. B. McMillan's tables on bare pipe loss (*Transactions A. S. M. E.* Vol. 37). After calculating and making allowance for heat loss in manholes from piping covered 1½-in. thick and expansion joints, uninsulated according to usual practice, the thermal efficiency was calculated as follows:

$$\text{Efficiency } \% = \frac{(\text{Heat loss from bare pipe} - \text{heat loss from insul. pipe}) \times 100}{\text{Heat loss from bare pipe}}$$

Results of Test and Recorded Data

Average steam pressure 50 lb gage; temp. 298 F, latent heat 911 Btu per lb.
Length line in conduit 532.5 ft; surface 1500.05 sq ft.
Normal temperature of ground 50 ft from conduit, 68 F; temp. difference 230 F.
Rate of heat flow bare pipe at 230 F temp. difference, 2.8 Btu per sq ft.
Average condensation, 81.972 lb per hr.....74,676.5 Btu
Heat loss from piping, etc. in 3 manholes and 2 anchor boxes.....31,183.1 Btu

Net heat loss from conduit.....42,493.4 Btu per hr.
Heat loss 532.5 ft 10-in. bare pipe = 966,032.2 Btu per hr.

Efficiency of insulation in conduit only =

$$\frac{(966032.2 - 42493.4) \times 100}{966032.2} = 95.6\%$$

Efficiency of entire section tested, including manholes and anchor pits, considering total distance of 580.5 lineal ft =

$$\frac{(1053000 - 74676.5) \times 100}{1053000} = 92\%$$

It is worthy of note that the temperature at the top of the conduit was 76 F, only 8 F above normal ground temperature.

Bad Threads And Their Cause

By **W. H. Wilson**

COST of installing piping is increased when delays interfere with the labor schedule. Among such delays, few create more trouble than poor and imperfect pipe threads.

(*To page 77, back Advertising Section*)

*District Engineer, The Ric-Wil Company, New York City.

INTERESTING Equipment..... Developments

A dual-purpose exhauster designed to handle unusual industrial air-removal problems has just been announced by The Allen Corporation, Detroit, Mich. It is a combination wind- and electric-motor-operated turbine ventilator; by manual switch or automatic thermostatic control, the exhaust may be increased from 100 to 200 per cent.

A worm geared-head motor and clutch are mounted on the top of the rotor, leaving the throat of the ventilator clear of any obstructions. The clutch operates on a free-wheeling principle; when power is applied two inner shoes are thrust outward mechanically and engage with the drum. The shoes are pulled in when the power is shut off and the turbine rotor revolves freely about the center bearing.

As the motor and driving mechanism are not in the path of the exhaust, it is not necessary to use special motors when inflammable gases, steam, dust- or particle-laden air are being handled. The motor is of the repulsion-induction type, with heavy starting torque.

Cools Railway Cars

The mechanical unit of the railway-car air conditioners developed by the Frigidaire Corporation, Dayton, Ohio, consists of a four-cylinder compressor which produces 5 tons of refrigeration when a 7.5-hp motor is used and 7 tons when a 10-hp motor is employed. The mechanical unit is in an oblong-shaped housing that is slung from the car frame. Both compressor and motor are readily accessible for routine checking. The refrigerant used is dichlorodifluoromethane, better known as F-12 or *freon*.

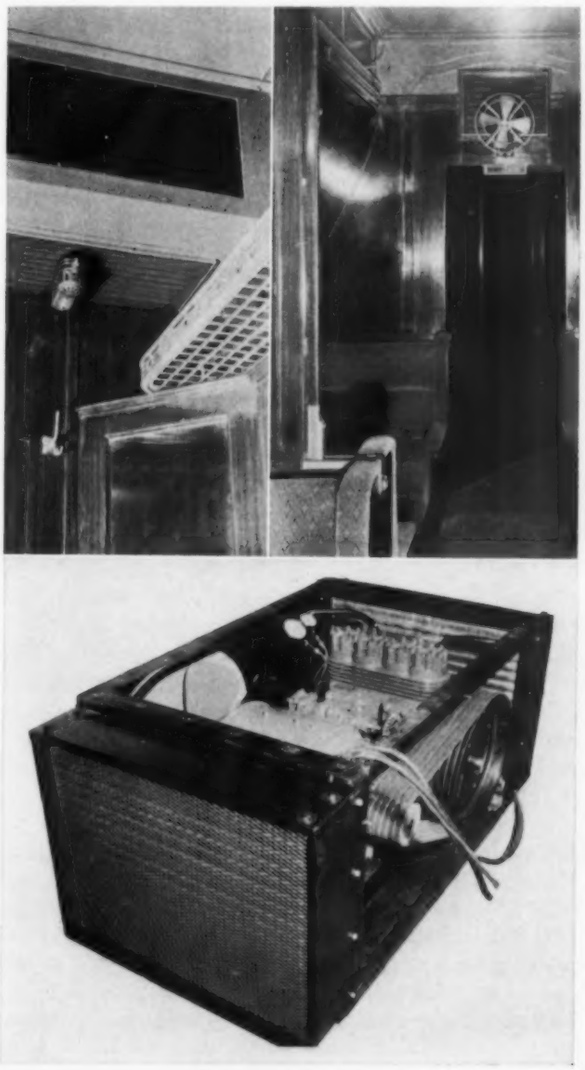
The refrigerant is carried from the compressor under the car to coils installed in the bulkheads by small refrigerant lines that are installed without necessitating alteration of the car structure.

In the case of a standard sleeping car of ten sections, one drawing room and two compartments, two large coils for installation in the bulkheads at the ends of the main section of the car and smaller coils for the drawing room, compartments and men's and women's dressing rooms are recommended. Fans behind the coils force the air through the cooling coils and grilles that deflect the conditioned air in the proper direction. Provision is made for introduction of new air to be mixed with the recirculated air. Excess humidity is reduced by condensing moisture as the air passes through the cooling coils.

The refrigeration requirement of a sleeping car operating under maximum heat and humidity conditions is estimated at five tons. This amount of refrigeration is also needed for a diner with seating capacity for thirty-six passengers and a crew of six, it is stated. The galley is not conditioned but a downdraft outlet over the door between the galley and dining space keeps a curtain of new air moving downward and into the galley at a rate sufficient to supply the regular exhaust fans so that the galley is ventilated without robbing the passenger section of refrigerated air. This method reduces the temperature in the galley by fifteen to twenty degrees, according to the manufacturer.

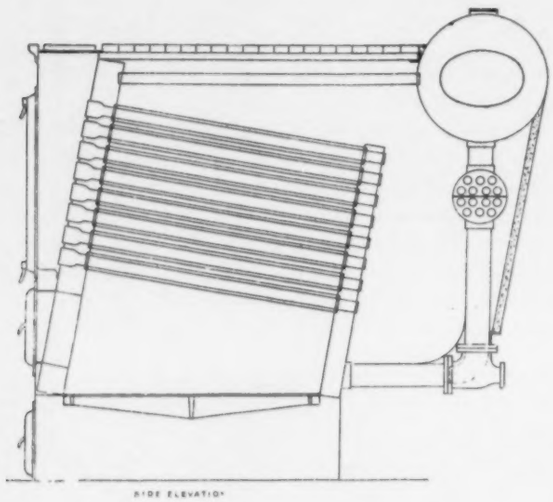
The refrigeration required to condition a coach with a passenger capacity of seventy to eighty passengers is estimated as approximately seven tons.

In the illustration, the bottom view shows the compressor unit and the two top views show cooling coil installations, the one to the left being in a small compartment.



New Compound Steel Boiler

A compound fire- and water-tube steel boiler made by the Boiler Repair Maintenance Co., New York City, lends itself to modernization projects as it can be taken down to pass through a 3 ft-6 in. by 7-ft door, a unique feature. It is constructed with staggered rows of concentric seamless drawn steel tubes, the outer tubes being 3½ in. and the inner tubes 2½ in. in diameter. This construction promotes fast steaming and the steam sweeps the heating surfaces clear to prevent corrosion and pitting. A water leg is provided on each side of the boiler, extending from the grates to the bottom of the lower tube. A baffle in the steam drum is aimed to eliminate any lifting of water.



The boiler can be fired with either coal, oil, or gas; for coal, the water-line is approximately seven feet above the floor but can be raised for oil burning. Ratings are from 10,000 sq ft of radiation up.

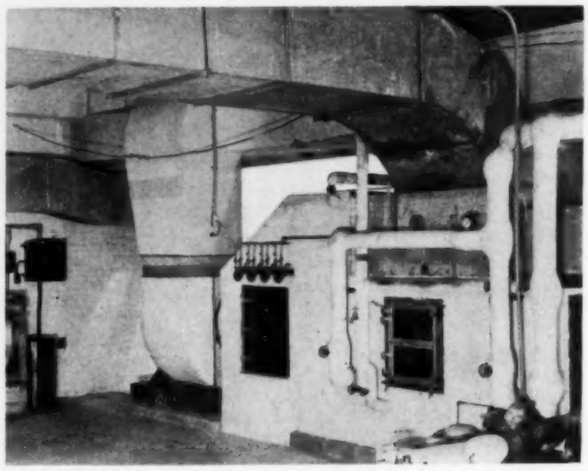
An auxiliary drum is located in the path of the products of combustion in the rear of the boiler and provides for the installation of copper coils for heating domestic service water. Another feature is an injector placed at the return connection for automatically injecting the boiler's returns.

Three New Insulation Products

Three new rock-wool insulation products have just been announced by The Standard Lime and Stone Company, Baltimore, Maryland. These new insulating cements retain the low thermal conductivity of rock wool, yet fill the need for a plastic form of insulation. This is accomplished by compounding the cellular rock wool fibers with special adhesive and heat-resisting materials. These mineral fiber compositions when mixed with water form adhesive, plastic cements with thermal conductivity of 0.650 Btu that will stick to clean (hot or cold) surfaces. The cements are applied rough and can be troweled to any desired degree of smoothness.

One of the cements is specially prepared for temperatures up to 1,650 F, and is recommended for high-temperature pipe fittings, breechings, boiler doors, water walls of boilers, cracking stills, etc. Its structural strength makes reinforcement unnecessary up to 1½-in. thickness. 100 pounds will insulate approximately 52 sq ft, 1 in. thick.

The second insulating cement has been developed for temperatures from 40 to 500 F. Developed for joints, unions, and elbows of steam lines, it may also be used for fittings, back walls of radiator enclosures, heating and ventilating ducts, etc., no reinforcement being needed. 100 pounds will cover approximately 49 sq ft, 1 in. thick. The illustration shows its application to air conditioning equipment.

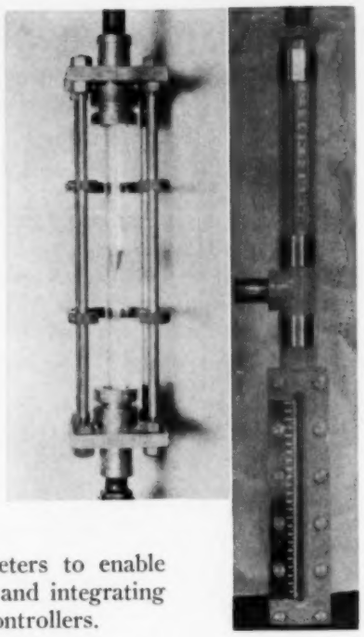


In addition, a finishing cement has been developed for use as a finishing coat over those previously described. It is not used as an insulation; 100 pounds cover approximately 35 sq ft, ⅜ in. thick.

Unique Flow Meterers

The flow-metering instruments of the type illustrated here (made by Schutte & Koerting Co., Philadelphia, Pa.) are used to show rates of flow of water, oil, air, gas, chemicals and other fluids, both liquid and gaseous. The instruments consist essentially of a vertical transparent tube having a tapered bore with the small end at the bottom. Inside the tube is a top-shaped float which is held in suspension by the upward flow. The float is entirely free and is caused to rotate rapidly by means of specially-shaped slots cut in its head against which the fluid being measured impinges. The float remains in the center of the tube, is frictionless in operation, and permits accurate readings. Calibration is a straight line. The scale is ordinarily calibrated in millimeters, a calibration chart being furnished in any desired units. Flows of 10 to 100 per cent of capacity can be measured.

The instrument shown at the left is for pressures up to 100 lb per sq in.; at the right is shown a high-pressure type equipped with a double-windowed chamber directly below the tapered measuring tube. A rod attached to the lower end of the float projects into the windowed cham-



ber to permit readings. This meter is being recommended for steam-flow measurements.

Suitable electric transmission equipment has just been designed for use with these meters to enable their use as recording and integrating instruments and flow controllers.

Double-Purpose Electric Hammer

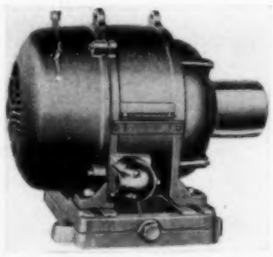
A new electric hammer has been designed by the Independent Pneumatic Tool Co., Chicago; it is a double purpose tool which can be used as a drill or hammer. It will drill, chip and channel concrete, brick, wood, etc., and is used in piping and electrical work, installing machinery and for similar purposes.

One of the features of the hammer is that it will also chip steel and drive light rivets. In hard limestone, it drills a ¾-in. hole 1¾-in. deep in one minute using the standard taper shank drill with holder. This time can be cut in half if the drill used is made solid with straight shank, which fits directly into the hammer, without an adaptor.

Specifications are: Blows per minute, 3,000. Length overall, 18 in. Weight, 16 lb. The following equipment is included with each tool: ¼-in. chuck, $\frac{9}{16}$-in. drill, tool holder and ejector pin and carrying case.

Fan-Seal Type Motors

Marble-Card Electric Company, Gladstone, Michigan, has announced a new line of fan seal type motors in sizes ranging from 2 hp at 900 to 30 hp at 1800 rpm. It is claimed that the new type motor is self-cooling, self-cleaning, self-protecting and being entirely enclosed is free from such hazards as dust, dampness and fumes. These new motors are aimed to eliminate danger of fires and explosions, reduce motor maintenance cost and eliminate the expense of special motor housings, boxings or ventilating systems, as they do not require protection and may be operated out-of-doors, subject to rain and snow.



Soldering-Iron Stand

A soldering-iron stand designed to effect a saving of 30-40% in power consumption and overcome soldering troubles has been announced by G-M Laboratories, Inc., Chicago. Difficulties result from an overheated, dirty iron, and defective soldering results from the tip of the iron becoming pitted and corroded from excessive heat. By keeping the iron always at the right soldering temperature, this trouble is corrected and the tip of the iron will remain well tinned.

The stand has two cradles. When placed in the left hand cradle the iron receives only sufficient voltage to keep it at the minimum and yet proper soldering temperature for immediate use. When the iron is either in actual use or is placed in the right-hand cradle, full line voltage is automatically applied to keep the iron up to temperature.

Reflects Radiant Heat

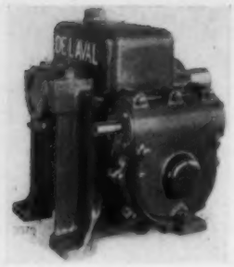
A new metal foil insulation especially designed for structures of frame construction but of general interest because the principle on which it is based has many applications in heating, piping, and air conditioning has been made available by Reynolds Metals Company, New York City. This new insulation is made in three types, two for application *against* studs, joists and rafters and a third with "flanged" edges for application midway *between* studs, joists and rafters. Each is furnished in rolls, the first two (one with metal surface on one side and the second with metal surfaces on both sides) 32 in. wide and the other type, 17 in. wide.

This insulation is composed of a kraft paper to which is cemented—with a waterproof asphalt cement—a shiny sheet of aluminum 0.0005 in. thick, on one or both sides, as previously mentioned. Such a surface will reflect radiant heat just as light is reflected; in addition, it has low emissivity so that little radiant heat is thrown off by such a surface. Brightness of the surface is maintained by an invisible oxide coating, naturally formed.

Obviously the bright surface must face an air space to reflect radiant heat; with the two types which are applied so as to face an air space on one side only, conductance is 0.41. The third type, applied so as to face air spaces both ways has a conductance of 0.206.

Worm Reduction Gear

The worm reduction gear has in recent years been adopted widely where slow or medium speed machinery is driven by high-speed motors or turbines, particularly for continuous operation under adverse conditions of moist or gritty atmosphere and infrequent attention, and where compactness, silence and freedom from danger are controlling requirements. In the new line of double-reduction worm gears produced by the De Laval Steam



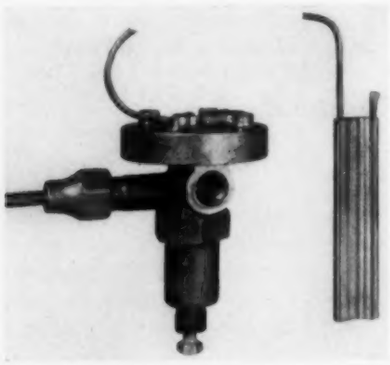
Turbine Co., Trenton, N. J., the high-speed gear wheel is mounted upon the slow-speed worm shaft, flexibility in the arrangement of the drive being gained by using separate housings for the high-speed gear and the slow-speed gear. For example, the unit with vertical slow-speed shaft can be combined in six ways, namely: with the high-speed shaft at the right and with the vertical driven shaft extending either upward or downward, or in both directions, and similarly with the high-speed shaft at the left. The unit with horizontal slow-speed shaft, can have the high-speed driving shaft extended in either or both directions, and likewise the slow-speed shaft. The worm may be rotated either clockwise or counter-clockwise, facing the worm from the motor or driving position. Standard gear sets are cut with right-hand threads.

All gear tooth and worm surfaces and the bearings are lubricated by a splash system, the high-speed gear wheel and the slow-speed worm dipping in an oil bath in the casing. The high-speed worm shaft and the shaft which carries the high-speed gear wheel and the slow-speed worm have ball bearings. The slow-speed shaft, which in double reduction gears may be called upon to carry considerable forces, has plain sleeve bearings, or in units in which the slow-speed shaft is horizontal, may be fitted with tapered roller bearings. The illustration shows a double-reduction worm gear with slow-speed shaft horizontal.

New Expansion Valve

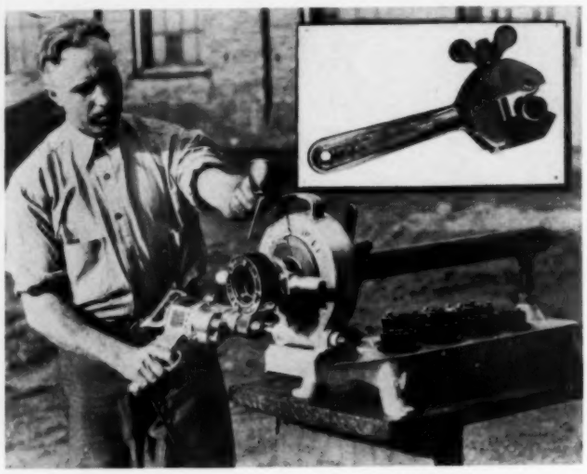
The latest development of the Alco Valve Company, St. Louis, Mo., is a new type thermostatic expansion valve that regulates accurately in cold temperatures. It is designed for methyl chloride, F-12, and sulphur dioxide.

Regardless of how cold the valve gets due to expansion of the refrigerant, or to being installed in a low-temperature room or box, the control always resides in the remote bulb and uniform regulation is assured even if the valve completely frosts over. The valve, which is compact and light in weight, can be installed in any position, location or temperature.



For Threading Pipe

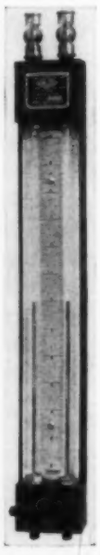
Illustrated below is a power adapter which has been made available by The Borden Company, Warren, Ohio, which may be operated by means of any standard electric or air drill to form a portable pipe machine which will thread all sizes of pipe up to 2 in. It has been designed with the needs of the small industrial plant particularly in mind. By using a ⅝-in. heavy-duty drill sufficient power is made available, according to the manufacturer, to drive geared tools for cutting and threading pipe up to 6 in. Operating speed of the die-head, under load, is from 10 to 15 rpm depending upon the size of drill used,



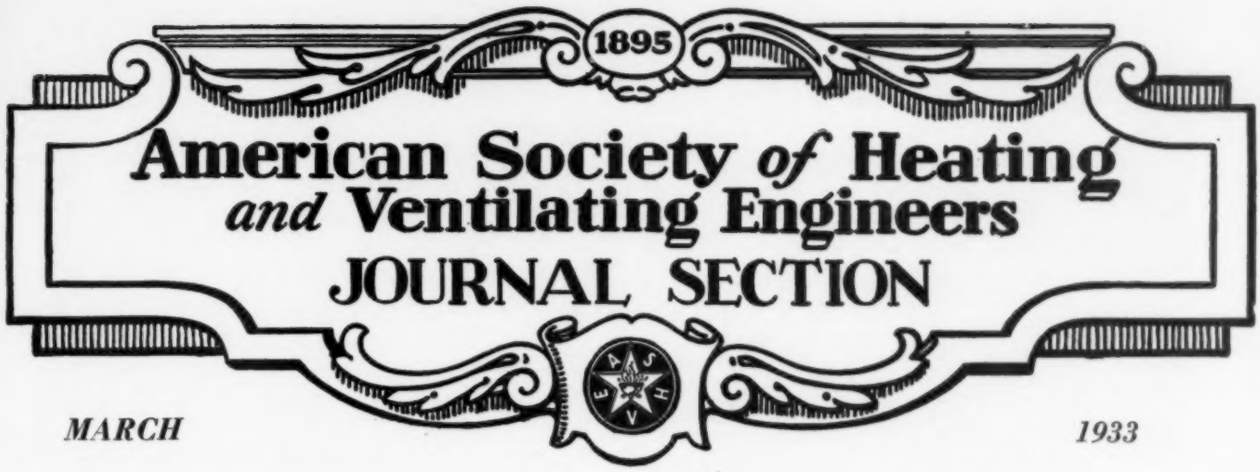
line voltage, condition of the dies, etc. The adapter will cut right- or left-hand threads and is reversible for backing off. A driving spud to fit all standard drill chucks is furnished as is a base and a full range of die-heads. The insert view shows a new tubing cutter offered for cutting ⅛-in. to ¾-in. tubing square, without burrs.

High Pressure Manometer

The manometer shown here and made by Morey & Jones, Ltd., Los Angeles, Calif., is designed to indicate differential pressures on high-pressure pipe lines, but due to its construction has many applications on low-pressure lines. It is employed for indicating rates of flow of all types of fluids, showing liquid levels, indicating static pressures, and for general test purposes. Regularly furnished for pressures up to 400 lb it may be had for 1500 lb per sq in. Features include mercury blow-over protection, bypass valve, and special scale markings.



Heating·Piping
and Air Conditioning



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Secretary, G. B. HOULISTON
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Secretary, S. D. PETERSON
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Pittsburgh Experiment Station of the U. S. Bureau of Mines where the Research Laboratory of the American Society of Heating and Ventilating Engineers is located

Condensate and Air Return in Steam Heating Systems

By **F. C. Houghten**[a] **and J. L. Blackshaw**[b] ***(MEMBERS)***

Pittsburgh, Pa.

DATA giving the relation between pressure drop and the rate of flow of water and air in pipe, covering a wide range of percentages of air to water for different sizes of pipe, were published[1] recently by the A. S. H. V. E. Research Laboratory. These data may serve as the basis of the capacities of return piping in steam heating systems, but before developing practical pipe size tables, it was considered desirable by the Technical Advisory Committee on Pipe and Tubing Carrying Low-Pressure Steam and Hot Water, of which S. R. Lewis is Chairman, that the characteristics of operation of actual heating systems be studied under practical operating conditions.

The results of the former paper[1] indicate that at any given pressure drop the capacity of a pipe for carrying either air or water is much greater than its capacity for carrying a mixture of both. Hence, the greatest demand on the capacity of the returns of a steam heating system will come sometime during the heating-up period when they must carry more than the normal amount of air eliminated from the heating units and pipe and when the condensation rate is greater than during continued operation.

This paper reports the results of a study of the returning air and condensate from two actual heating systems during and after heating up, with both gravity and vacuum pump operation. One study was made on a two-pipe gravity vapor system in a 12-room residence containing 640 sq ft (equivalent) of direct radiation; the other, on that part of the vacuum pump differential system in the Grant Building, Pittsburgh, on the 34th to the 39th floors, which contained 2,510 sq ft (equivalent) of concealed, extended surface copper radiation.

Test Set-up and Operation

The pipe system and the arrangement of the test equipment for gravity operation in the residence are shown in Fig. 1, in which the size of the pipe and the size and location of the radiators are indicated. In this system steam was supplied by the boiler, the condensate was separated from the returning air near the point where the regular air relief valve had been located, and the air was eliminated through the air orifice flow meter and the wet gas meter. The orifice in the orifice flow meter was made of a size approximating the orifice opening in air relief valves for heating systems of the sizes studied. As the Technical Advisory Committee on Pipe Sizes recommended orifices of $\frac{1}{16}$ in. for systems containing up to 1,500 sq ft equivalent radiation, tests on

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[1] A. S. H. V. E. Research paper entitled, Flow of Condensate and Air in Steam Heating Returns, by F. C. Houghten and Carl Gutberlet (*Heating, Piping and Air Conditioning*, December, 1932).

Presented at the 39th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Cincinnati, Ohio, January, 1933.

the two systems were made with both $\frac{1}{16}$ and $\frac{1}{8}$-in. orifices. The wet gas meter used to measure the volume of air eliminated was sufficiently large so that the pressure drop through it never exceeded 0.1 in. of water column. Pressures were observed by manometer at the points P_1 to P_3 as indicated in the figure; temperatures were read by thermometer at points T_1 to T_3. The condensate was returned by gravity into the condensation weighing bucket.

Petroleum coke, which gave a very high and uniform rate of combustion, was used to fire the boiler in the residence. A steam pressure of 10 lb was developed in the boiler before the beginning of the test and this pressure was regulated by blowing the excess steam to the atmosphere through the relief valve, V_1. When conditions were ready for test, steam was turned into the system by opening and adjusting the valve, V_2, until the desired pressure on the supply side of the system was indicated by the manometer. The rates of returning condensate and air were observed each minute.

Fig. 2 is a diagrammatic sketch of the pipe system and the arrangement of the test equipment for vacuum pump operation as used for the tests in the 40-story Grant Building. The floors above the 33rd are heated by steam distributed through upfeed supply risers taken from the 10-in. supply main *BC*, which makes a loop above the false ceiling of the 33rd floor. In the sketch, the equivalent sq ft of radiation on each floor served by each pair of supply and return risers are indicated as a single unit, but actually this radiation in most instances included several units. The returning air and condensate from all return risers were collected through branches and mains between the 33rd and 34th floors at *A*, from which point they were carried to the condensate and air receiver and then to the vacuum pump, which delivered the air through the air orifice flow meter and the wet gas meter to the atmosphere, while the condensate was sent to the calibrated condensation measuring tanks. Pressures and temperatures were read on manometers and thermometers located at the respective points, P_1 to P_3 and T_1 to T_3.

In operating the system in the Grant Building by vacuum pump, the predetermined steam pressure was maintained constant in the supply main. Before starting a test the desired vacuum on the return side of the system, as indicated by the manometer, was obtained. with the vacuum pump and through operation of valves V_1 and V_2. At the instant of starting the test the ten steam supply valves V_3 to V_{12} were opened; the time required in opening these valves never exceeded one minute. Except for the period immediately after steam had been turned into the system, when for a very few minutes the desired vacuums were not always maintained, the pressure in the return side of the system was held constant throughout a test. The weight of condensate and the volume of air removed from the system were observed at frequent intervals. The time when all radiators had become heated to steam temperature was taken as the end of the heating-up period, though the test was continued beyond this time to insure that a constant rate of return of condensate and air had been reached.

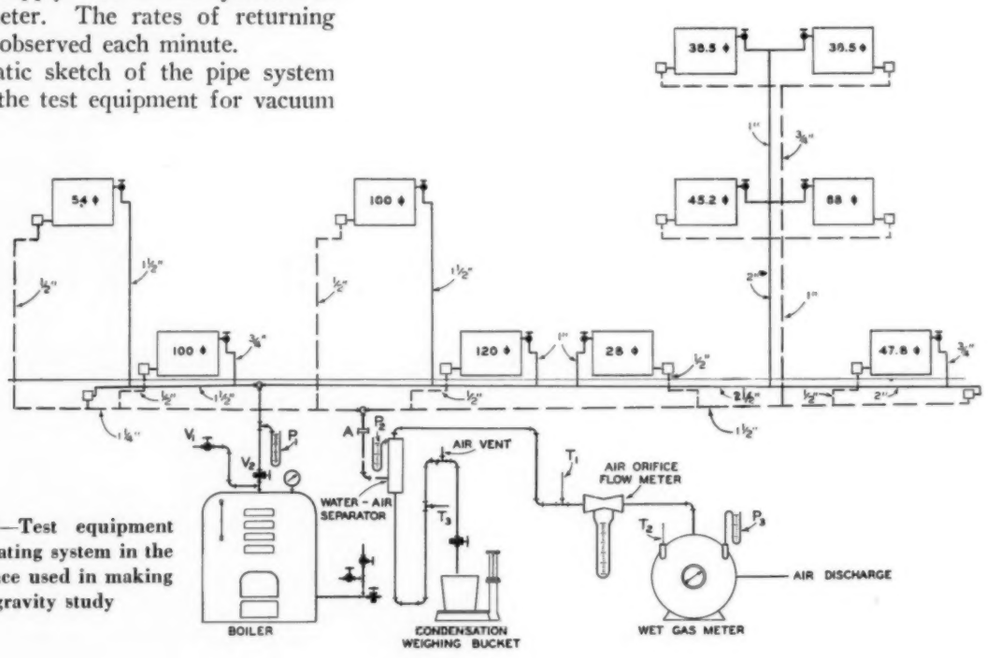


Fig. 1—Test equipment and heating system in the residence used in making gravity study

Gravity return tests were conducted in the Grant Building in a manner similar to the vacuum pump tests, except that the gravity flow measuring equipment shown in Fig. 1 was attached at *A* instead of the vacuum pump arrangement of Fig. 2. The condensate and air were separated and measured in the same way as in the gravity test in the residence.

Results

Three tests were made on the system in the Grant Building with gravity operation, six in the Grant Building with vacuum pump operation, and two tests were made on the gravity return system in the residence. Test data and conditions under which each test was made

Table 1—Test Data and Conditions

Test Number	Test Location	Type of Test	Size of Orifice (In.)	Supply Pressure (Lb per Sq In Absolute)	Return Pressure (Lb per Sq In Absolute)	Pressure Difference (Lb per Sq In.)	Average Pressure in System (In. Hg Gage)	Steam Temperature (Deg Fahr)	Room Temperature (Deg Fahr)	Heating-up Period (Minutes)	Elapsed Time to Max Air Elimination (Minutes)	Elapsed Time to Max Condensate Elimination (Minutes)	Elapsed Time to Max Pressure Drop (Minutes)
1	Grant Bldg.	Gravity	1/16	16.27	14.24	2.03	+ 2.06	213.8	70	40	4.5	31.0	29.5
2	Grant Bldg.	Gravity	1/8	15.30	14.24	1.06	+ 1.08	212.2	78	37	0.5	26.0	15.0
3	Grant Bldg.	Gravity	1/8	16.27	14.24	2.03	+ 2.06	213.8	80	20	1.0	13.0	12.0
4	Grant Bldg.	Vacuum	None	13.91	12.83	1.08	− 1.90	207.4	80	20	1.5	9.5	7.5
5	Grant Bldg.	Vacuum	None	9.52	8.41	1.11	−10.88	188.0	80	27	0.5	19.0	19.0
6	Grant Bldg.	Vacuum	None	9.54	8.92	0.62	−10.39	189.5	80	15	2.0	7.0	7.0
7	Grant Bldg.	Vacuum	None	13.91	13.46	0.45	− 1.27	208.5	80	25	1.0	13.0	13.0
8	Grant Bldg.	Vacuum	None	9.54	8.77	0.77	−10.56	189.0	80	24	4.0	11.5	11.5
9	Grant Bldg.	Vacuum	None	11.97	11.34	0.63	− 5.43	200.5	81	21	3.0	11.0	11.0
10	Residence	Gravity	1/8	14.84	14.33	0.51	+ 0.53	211.6	78	33	2.0	8.0	7.5
11	Residence	Gravity	1/16	15.32	14.32	1.00	+ 1.02	212.4	76	50	2.5	5.0	5.0

are tabulated in Table 1. In Fig. 3 the rates of returning condensate and air are plotted against elapsed time, from the instant when steam was turned into the system, for each of the nine tests in the Grant Building, and in Figs. 4 and 5 for the gravity tests made at the residence. Besides showing the curves for air and condensate, Figs. 4 and 5 graph the steam pressure maintained at the supply end of the system, and the pressure drop through the system from the steam supply to the end of the return just before the orifice. The separation between the steam supply pressure curve and the curve for the pressure drop through the system represents the pressure drop through the orifice.

It will be noted in these tests that immediately after steam was turned into the supply side of the system air began to be eliminated at the farthest end of the return. The rate of air elimination quickly reached a maximum, and then receded rapidly to a rate much lower, from which it continued to decrease more slowly until a constant rate of elimination was reached. The condensation, on the other hand, did not flow from the system until several minutes after the steam was turned on. It reached its maximum rate slowly and then diminished to its constant rate. The arrows pointing up to the condensation curves indicate the end of the heating-up period.

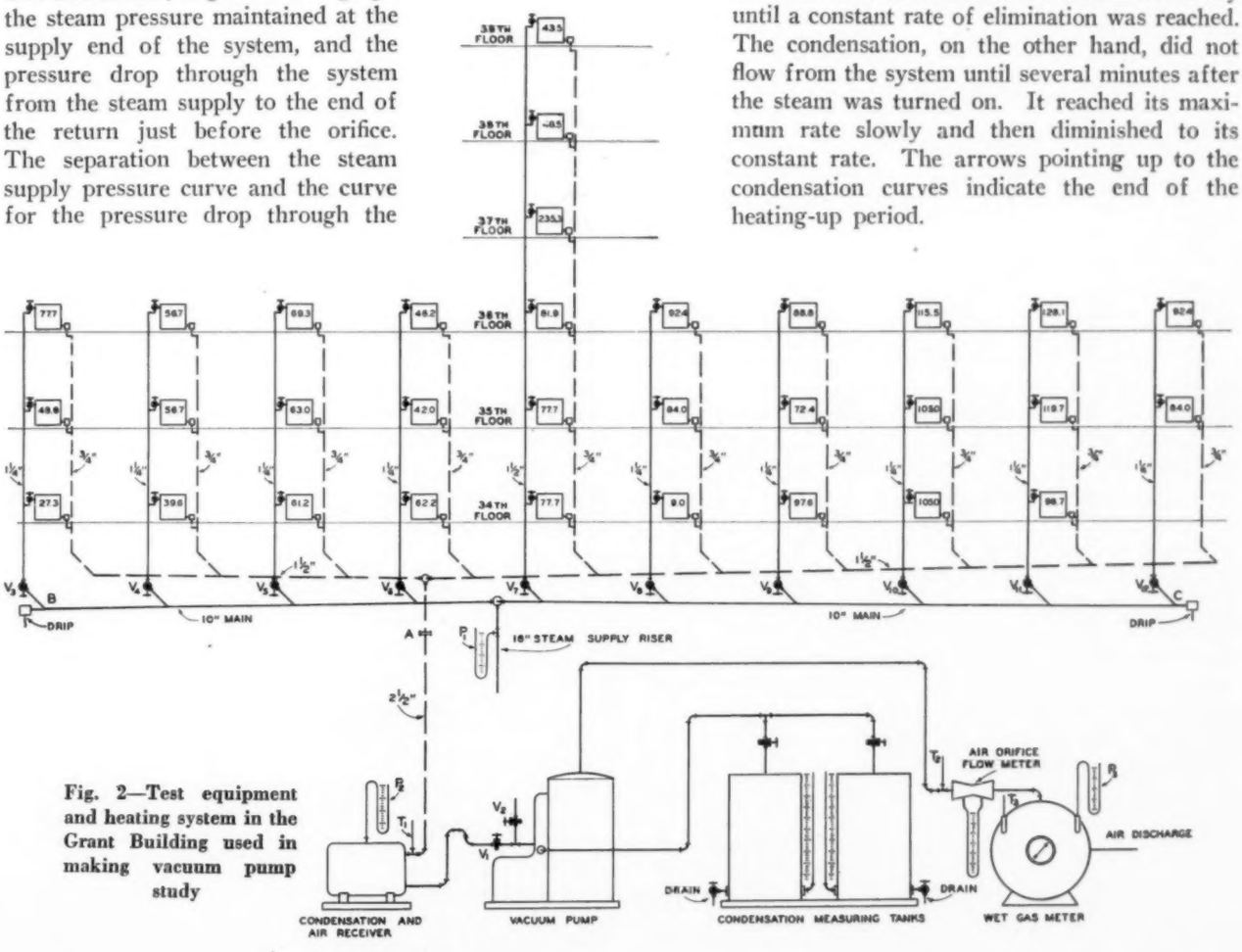


Fig. 2—Test equipment and heating system in the Grant Building used in making vacuum pump study

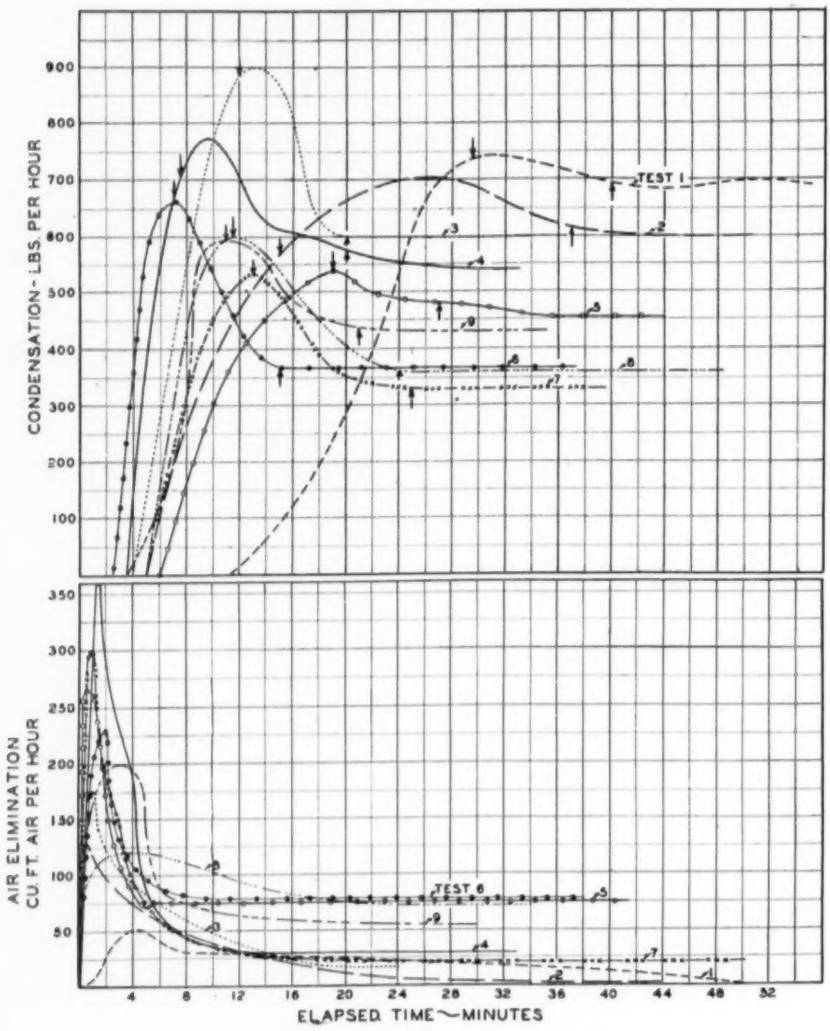


Fig. 3—Relation of elapsed time to air elimination and to condensation return in the heating system at the Grant Building

In Fig. 3 the different curves for air and condensate show a marked similarity. Certain variations in the curves bear a definite relation to steam pressure and pressure drop through the system; however, sufficient tests were not made to evaluate these relations accurately.

Conditions during steady heated-up operation at the Grant Building are shown in Fig. 6, where the lower curve gives the relation between the observed rate of constant condensate return and the temperature difference between the steam in the system and the air in the rooms. The steam temperature was taken from steam tables for an absolute pressure equal to the mean between those of the supply and the return. As would be expected, the rate of condensation return increases with increase in temperature difference. The calculated curve shows the relation between the rate of condensate return and the temperature difference; it is based upon the installed radiation (2,510 sq ft) plus a ten per cent allowance for condensation in the return pipe, assuming 240 Btu emission per square foot for a temperature difference of 145 deg between steam and air, and assuming that for other temperature differences the condensation varies as the 1.3 power of the temperature difference. It will be seen that the rate of return in the Grant Building, as indicated by the observed curve, increases more rapidly with increased temperature difference than as indicated by the calculated curve.

Excepting for the small volume of non-condensable gases contained in the steam, the air elimination from a system should, if there is no leakage, decrease to zero upon complete heating-up. The constant rate of air elimination after heating-up therefore represents leakage which should be a function of the difference in pressure between the atmosphere and the inside of the system. This rate of air leakage is plotted in Fig. 7 against pressure difference for the tests made under vacuum pump operation.

The relation between the maximum rate of condensate return during the heating-up period and the pressure drop through the system from the supply main to the end of the return is given in Fig. 8 for both gravity and vacuum pump tests

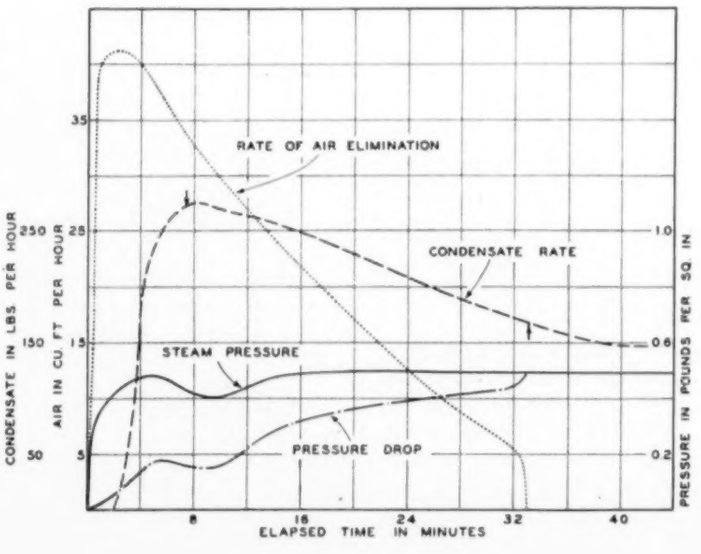


Fig. 4—Relations between elapsed time and data from Test 10 in the residence—½ lb steam pressure—⅛-in. orifice air relief

in the Grant Building. As would be expected, the maximum rate of condensate return during the heating-up period increased with increased pressure drop through the system, or with the rate of advance of steam through the system. The relation in the Grant Building tests between the maximum rate of air elimination during the heating-up period and the pressure differences through the system during the times of these maximums is shown in Fig. 9, and indicates that the maximum rate of air elimination also increases with pressure drop through the system.

The most striking fact in Fig. 3 concerning the condensation return and the air elimination return is the short time required for the elimination of most of the air from the system. In all cases the maximum rate of air elimination comes much earlier than the maximum rate of condensation return. In fact, in all cases the air elimination rate has reached its maximum and receded to a much lower rate during the first five minutes; whereas the condensation return rarely approaches its maximum rate until a later time. This is a most significant fact bearing on the needed capacity of the return for carrying condensation and air during the heating-up period, for if the air elimination maximum were coincident with the condensation return maximum, the load on the system at this point would be greater and larger pipe would be required. The curves show that the tax on the capacity of the pipe caused by the air elimination comes earlier than and is rather independent of the tax on the pipe caused by the return condensate. These facts are shown in Table 2, in which comparative data are listed for analysis of the different tests studied.

Column 2 of Table 2 gives the total volume of air eliminated from the system during the heating-up period, Column 3 gives the volume of air leakage into the system during the heating-up period because of the vacuum maintained, and Column 4 gives the difference between these two columns or the net air that would have been eliminated during the heating-up period had there been no in-leakage. It should be emphasized that, unless otherwise stated, volumes of air shown in the figures and tables are the volumes measured by the wet gas meter under the prevailing temperature and pressure in the meter, which were practically those of the atmosphere. Because atmospheric conditions were not had in the system before a test was started, its temperature being usually higher and its pressure usually lower than

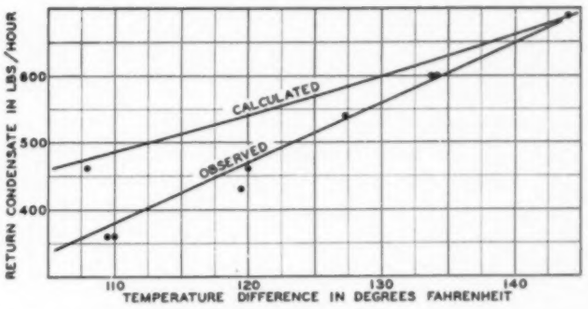


Fig. 6—Observed and calculated relations between temperature difference (steam to air) and condensation return

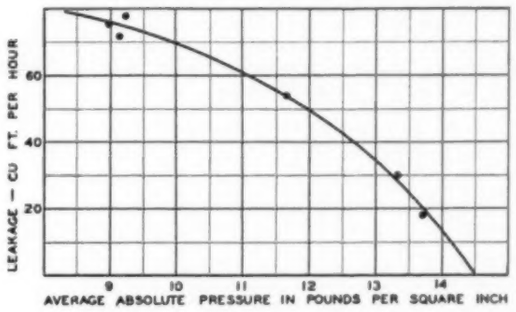


Fig. 7—Relation between average absolute pressure and air leakage

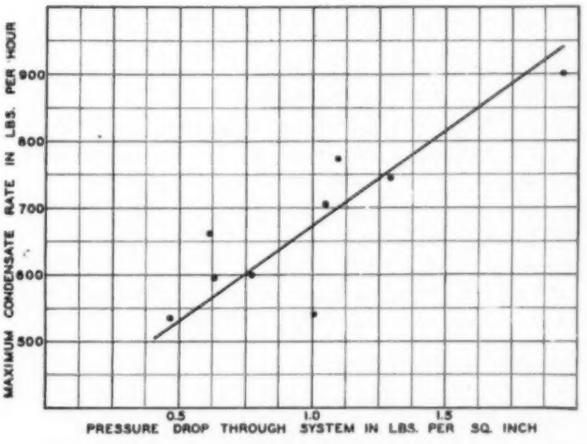


Fig. 8—Relation between pressure drop through the system and maximum rate of condensation return for all tests in the Grant Building

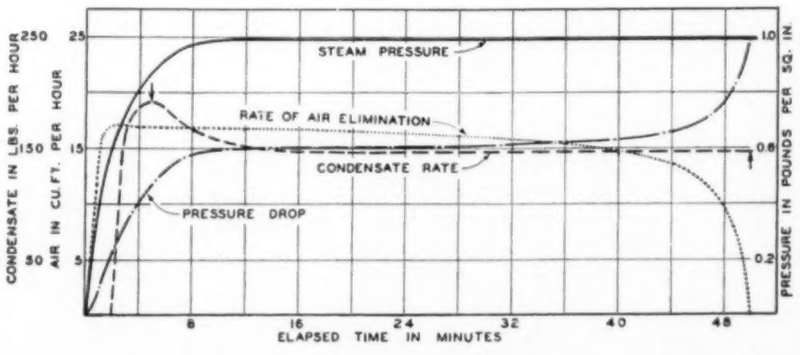


Fig. 5—Relations between elapsed time and data from Test 11 in the residence—1 lb steam pressure—1/16-in. orifice air relief

those registered on the meter, it is necessary to correct the metered volumes for the temperatures and pressures in the system to obtain the actual capacity of the system.

All of the air in the supply pipe and heating units should be eliminated during the heating-up period, and if the thermostatic traps work perfectly, steam should not enter the return. However, the hot condensate flowing through the return will so raise the temperature of the air contained therein and expand its volume that a large part of it will also be forced out. The val-

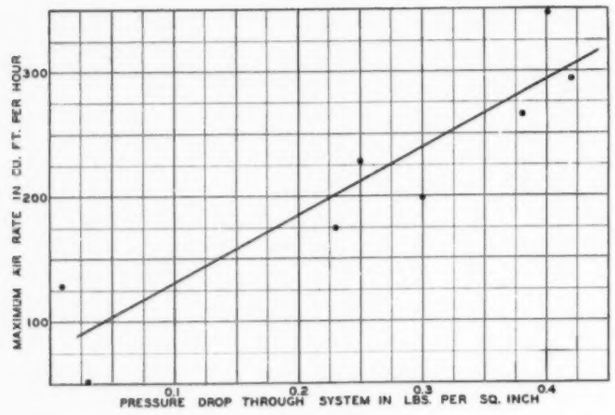


Fig. 9—Relation between pressure drop through the system and maximum rate of air elimination for all tests in the Grant Building

ues given in Column 4 for the net volume of air eliminated from the system during the heating-up period are corrected in Column 5 for the prevailing pressure and the estimated temperature within the system.

Values shown in Column 5 should therefore represent the volume of the air contained in the system before the steam was turned on, or the volumetric capacity of the supply pipe, the radiators, and a part of the return piping. A calculation of the volumes of the supply pipe, the heating units, and the returns, based on the size and length of pipe and the size and volumetric capacity of the heating units, gives for the Grant Building the values 10.5, 4.4, and 3.5 cu ft for the supply pipe, heating units, and return pipes, respectively, or a total volume of 18.4 cu ft for the entire system; and for the residence, 3.6, 11.1, and 0.8 cu ft, respectively, or a total of 15.5 cu ft. It will be noted that the corrected volumes of air eliminated from the two systems check fairly well with their total volumetric capacities.

Column 6 gives the net volume of air eliminated up to the time of maximum rate of condensation return, and Column 7 reduces this volume to a percentage of the volume of air eliminated during the entire heating-up period. Likewise, Column 8 gives the net volume of air eliminated up to the time when the rate of condensation is half of its maximum, while Column 9 reduces this volume to its percentage of the volume eliminated during the entire heating-up period. It is of interest to note that for the tests in the Grant Building the air eliminated from the system up to the time of maximum condensation represents a range of from 71 to 100 per cent of the total eliminated during the heating-up period, an average for all tests of 92 per cent, while for the period up to the half-maximum point the air eliminated represents an average of 75 per cent of the total eliminated for the entire heating-up period. The similar percentage relations are lower in the tests made in the residence. This can be explained by reference to the curves for these tests in Figs. 4 and 5. Although the pressure in the boiler was built up to ten pounds before the steam was turned into the system, the small steam storage capacity of the boiler, compared with the larger volume of the supply piping, resulted in an immediate drop in steam pressure, which did not again reach the desired value until several minutes later. Also, during the early part of the tests, the greater part of the pressure difference between the steam supply and the atmosphere was required to force the air through the orifice, so the rate of air elimination did not quickly reach its peak, which was broader and continued for a longer time. The $\frac{1}{16}$-in. orifice used in Test 11 in the residence and in Test 1 at the Grant Building was obviously too small to allow the air to leave the systems quickly. The retardation of the rate of air elimination from the system by the small orifices should not necessarily be considered an undesirable limitation, for one of the accepted, although not generally recognized, functions of a good air relief valve is to control the rate of air elimination and therefore the rate of steam supply to the system during

Table 2—Analysis of Test Data

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Test Number	Total Air Eliminated Heating-up Period (Cu Ft)	Total Air Leakage Heating-up Period (Cu Ft)	Net Air Eliminated Heating-up Period (Col 3—Col 2) (Cu Ft)	Corrected Net Air Eliminated Heating-up Period* (Cu Ft)	Net Air Eliminated to Time of Max Cond (Cu Ft)	Percentage Col. 6 / Col. 4 X 100	Net Air Eliminated to Time of Half Max Cond. (Cu Ft)	Percentage Col. 8 / Col. 4 X 100	Ratio—Air to Cond. at Time of Max Cond (Cu Ft per Lb)	Constant Rate Cond Return (Lb per Hour)	Max Rate Cond Return (Lb per Hour)	Percentage Col. 12 / Col. 11 X 100	Max Pressure Drop 1¼-In. Pipe (Oz per 100 Ft)	Percentage that Max. Cond Rate is of Designed Cond Rate	Ratio—Air at Max Cond to 143% of Designed Load (Cu Ft per Lb)
1	15.4	0.0	15.4	15.6	14.1	92	9.9	64	0.02	690	744	108	0.45	118	0.02
2	16.8	0.0	16.8	16.9	14.6	87	10.8	64	0.01	600	705	118	0.22	112	0.01
3	17.9	0.0	17.9	18.0	16.9	95	9.2	51	0.04	600	900	150	1.20	143	0.04
4	28.5	10.0	18.5	20.8	17.2	93	15.2	82	0.04	540	771	143	0.77	122	0.04
5	39.6	33.0	6.6	11.3	6.5	100	6.5	100	0.14	462	540	117	0.46	86	0.08
6	26.0	19.3	6.7	19.3	6.7	99	5.7	84	0.13	360	660	183	0.96	104	0.09
7	24.4	9.3	15.1	16.3	14.3	94	14.1	93	0.05	330	534	162	0.20	83	0.03
8	38.6	28.8	9.8	16.2	7.0	71	4.8	49	0.16	360	600	167	0.84	95	0.01
9	32.2	18.9	13.3	16.9	12.4	93	11.2	84	0.11	432	594	138	0.55	94	0.01
Averages				16.8		92		75	0.08			143			
10	11.8	0.0	11.8	11.8	8.3	70	2.3	18	0.14	144	155	108	0.02	97	0.10
11	12.5	0.0	12.5	12.5	1.2	10	0.5	4	0.09	147	194	132	0.00	121	0.07

* Volume in Column 5 corrected for temperature and pressure in pipe.

the heating-up period to avoid noisy operation during this time.

Column 10 of Table 2 gives the ratio of the rate of total air elimination to the rate of condensation return when this return is at its maximum. Columns 11, 12, and 13, give, respectively, the condensation rate after it had become constant at the end of the heating-up period, the maximum condensation rate during the heating-up period, and the percentage which this maximum rate is of the constant rate. It will be observed that the ratio of air to condensate at the time of the maximum condensation load ranges from less than 0.01 cu ft per pound of condensate to 0.16 cu ft, giving an average for all tests in the Grant Building of 0.08. These ratios for tests in the Grant Building are plotted against the average absolute pressures within the system in Fig. 10. It will be observed that the ratio increases as the absolute pressure in the system decreases, or as the vacuum applied increases. This increase in the ratio with vacuum applied is obviously the result of air leakage into the system. The ratios due to elmination of air, after correction for leakage, range down from 0.05 cu ft per pound as shown by the points X at the lower part of the figure. The tests in the residence, where there was no in-leakage of air, show ratios greater than 0.05 cu ft per pound of condensate at the time of maximum condensate return, due to the slowing up of elimination of air from the system because of the orifices used.

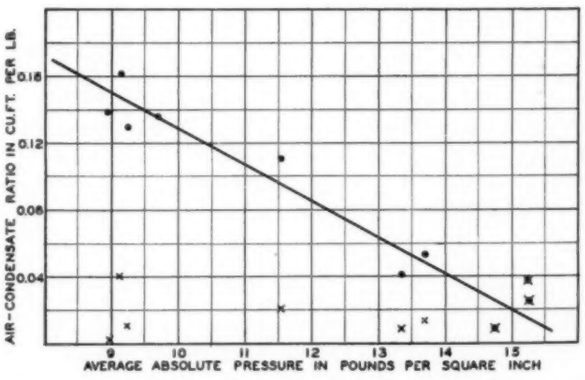


Fig. 10—Curve showing relation between the average absolute pressure and the ratio of total air to condensate at the time of maximum condensation; points "X" show relation between the average absolute pressure and the ratio of net air to condensate at the time of maximum condensation for all tests in the Grant Building

This higher ratio is therefore accompanied by decreased maximum condensation rates, as is indicated in Column 13, which tabulates the percentage relation between the maximum and constant condensation return rates. In the Grant Building the maximum rate of condensation return ranged up to 183 per cent of the constant condensation rate, with an average of 143 per cent, while in the residence the maximum condensation rates are 108 and 132 per cent of the constant rate for the two tests. This indicates that the maximum rate of condensation return is decreased during the heating-up period, when because of the retardation of elimination of air at the time of maximum condensation, the ratio of air to condensate is increased. As the ratio of air to condensate during the heating-up period increases, tending to indicate a greater load on the system, the condensation rate decreases and compensates the need for larger sized pipe. In general, those tests in which during the heating-up period the maximum condensation rate is the greatest percentage of the constant condensation rate are tests with a high vacuum or low absolute pressure, resulting in both a lower maximum and a lower constant condensation rate, which compensation again tends to lessen the need for excessive pipe sizes.

It is of interest to study the combined tax on the return piping resulting from the various combinations of water and air flowing during and after the heating-up period. Results of Test 9 at the Grant Building are shown in Fig. 11, in which the air elimination and condensation return curves are plotted together with a derived curve showing pressure drop for 1¼-in. pipe. The pressure drop during the time when air only was flowing through the return was calculated from an accepted formula[2] for the flow of air in pipe. For both air and water flowing through the pipe the pressure drop was calculated from the following formula developed in a previous Laboratory paper[3]:

$$L = (2.18\ P^{0.04839} - P^{0.38588} \log R)\ (157.08\ d^2 + 80) - 500 \quad (1)$$

where

L = condensation load in pounds per hour
P = pressure drop in ounces per 100 ft
R = ratio—cubic feet of air per pound of condensate
d = actual internal diameter of pipe in inches.

It will be noted from the curve that the pressure drop, resulting from carrying only air at the high elimination rate immediately after turning on the steam and before the condensation return becomes an important factor, is small and increases to a maximum at the time of the maximum condensation rate, from which it recedes as the rate of air elimination decreases.

Column 14 of Table 2 lists for each test the pressure drop in ounces per 100 ft of 1¼-in. pipe as calculated for the point of greatest pressure drop, indicated by

[2] *Marks Handbook*, Third Edition, p 376.
[3] A. S. H. V. E. Research paper entitled, Flow of Condensate and Air in Steam-Heating Returns, by F. C. Houghten and Carl Gutberlet. (*Heating, Piping and Air Conditioning*, December, 1932).

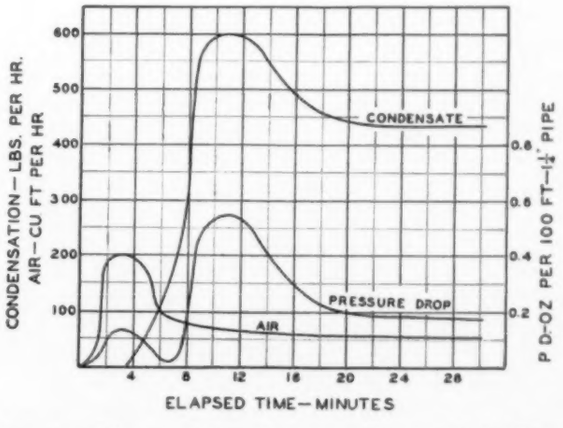


Fig. 11—Relation of elapsed time to the rate of air elimination from the system to the rate of condensation return, and to the calculated pressure drop for 1¼-in. return. All data from Test 9

the arrows pointing downward to the curves, Figs. 3 to 5. In the few cases where the maximum pressure drop did not coincide with the point of maximum rate of condensate return, the calculation of the pressure drops for the two points showed the variation to be negligible. Since the maximum pressure drop or the maximum tax on the system comes usually at the time of the maximum rate of condensation return, it depends upon the maximum rate of condensation return and the related rate of air elimination.

It is not desirable to take into account all the varying factors including, among others, absolute pressure, pressure drop, orifice size, and volumetric capacity of the system in determining pipe sizes for a given system. However, it would seem expedient to base pipe sizes on a condensation return rate equal to an accepted percentage of the condensation rate for the installed radiation under standard conditions with a logical ratio of air to condensate.

It might appear that a system operating under a high vacuum would require larger pipe sizes than one operating at a high absolute pressure, because with increased vacuum on the system there was an increase in the percentage relation which the maximum condensate return rate bore to the constant condensate return rate and also in the ratio of air to condensate at the time of maximum condensate. This is, however, because the values on which the percentages and ratios are based are smaller for the vacuum system. In order to bring this fact out, the percentage which the maximum condensation return is of the steady condensation return is given in Column 15, as calculated from the installed radiation under standard conditions. In the Grant Building this designed condensation load is $\frac{2510}{4} = 628$ lb per hour, and in the residence it is $\frac{640}{4} = 160$ lb per hour. Column 16 gives the ratio of the air elimination at the time of maximum condensation return to the maximum rate of condensation return, which is based on the largest percentage found in Column 15, or 143 per cent, and on the calculated constant condensation rate for the installed radiation operating under standard conditions. For the Grant Building this rate of condensation return is 143 per cent of 628, or 900 lb per hour, and for the residence it is the same percentage of 160, or 229 lb per hour.

It is of interest to speculate on what the increased tax on the system in the Grant Building would have been if tubular cast iron heating units had been used instead of copper radiation. The total volumetric capacity of supply, return and radiation in the Grant Building was found to be 18.4 cu ft, made up of 14 cu ft in the piping and 4.4 cu ft in the heating units. The volumetric capacity of this type of copper radiation was found by measuring twelve heating units of different size which averaged 0.00174 cu ft per square foot of radiation. In an earlier Laboratory study,[4] measurement of fifteen tubular cast iron radiators of various sizes and four different makes showed an average volumetric capacity of 0.0142 cu ft per square foot of radiation. Therefore, if the same number of equivalent sq ft of tubular radiation had been used in the Grant Building, the volumetric capacity of the radiation would be 35.7 cu ft, which, increased by piping, would give 49.6 cu ft as the total volumetric capacity of the system—a total volumetric capacity about three times as great as was found with copper heating units. It would be difficult to determine accurately the effect which this increased volume of air would have on the tax on the system during the heating-up period without testing a number of similar systems containing different types of radiation. The assumption may be made, however, that the rate of progress of water through the system would be slowed up, allowing a large part of the excess air to be expelled before the condensation load reached its maximum, and that the increased ratio of air to condensate at the time of maximum condensation return would not be proportionately larger. Instead of air ratios of 0.05 cu ft per pound of condensation or less at time of maximum condensation return as indicated in Fig. 10 for a system operating at atmospheric pressure, and therefore without leakage, the ratio of air to condensate under the assumed conditions using tubular radiators may not be increased beyond 0.1. However, it should be emphasized that this assumption is not based on test data.

The increased rate of air return during the time of maximum condensation return for a system operating under vacuum as shown in Fig. 10 should not indicate the need of larger returns for vacuum pump systems designed to operate at considerable vacuum, for the reason that such systems should be designed to operate at high vacuum only during mild weather when the demand on the system is below maximum. It would be expected that a vacuum pump system should operate at or above atmospheric pressure at the time of maximum heating demand, thus making its maximum demand during the heating-up period no different from that of a gravity system operating at atmospheric or slightly higher pressure.

Conclusions

The foregoing facts should be considered, together with the fact that the maximum rate of condensation never reached more than 143 per cent of the designed condensation load, and the fact that in the system with copper radiation the air-condensation ratio at the time of maximum load never exceeded 0.05 cu ft of air per pound of condensate when the system operated at or above atmospheric pressure, or when there was no leakage. From such consideration it would seem reasonable to recommend that return pipe sizes for vacuum systems be based upon a maximum condensation load during the heating-up period of 150 per cent of the designed condensation load under standard conditions, and a ratio of 0.10 cu ft of air per pound of condensate, allowing possibly a slightly smaller ratio of air for systems containing radiation with small volumetric capacity and a slightly higher ratio for systems containing radiation with large volumetric capacity. Return pipe sizes in gravity systems should allow a larger factor of safety, and hence it is recommended that they be based on 175 per cent of the designed condensation load under standard conditions and a ratio of 0.15 cu ft of air per pound of condensate.

[4] Capacity of Dry Return Mains for Steam and Vapor Heating Systems, by F. C. Houghten and Carl Gutberlet. A. S. H. V. E. Transactions, Vol. 36, 1930.)

Report of the Committee on Research for 1932

By G. L. Larson, *Chairman*, and F. C. Houghten, Director of Research Laboratory

THE Committee on Research of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS held four meetings during 1932, two during the Annual Meeting at Cleveland in January, one in Pittsburgh in April, and one at the time of the Semi-Annual Meeting in Milwaukee in June. Financial difficulties resulting from the depression, and the problem of scaling down activities to make expenditures come within diminishing receipts occupied a large part of the Committee's deliberations. In this connection it was found necessary to curtail some of the research activities and otherwise reduce expenditures. Funds to meet the budget were derived from dues of Society members, interest on reserve funds, proceeds from the Second International Heating and Ventilating Show in Cleveland, profits from the publication of THE GUIDE, and contributions from industry.

BUDGET 1932
Revised April 8, 1932*

Income	Budget 1932	Actual 1932
A. S. H. V. E. Dues and Guide	$20,000.00	$16,795.92
Manufacturers	5,000.00	5,745.00
Association	3,000.00	3.525.00
Exposition	2,250.00	5,012.76
Other Contributions	5,000.00	2,500.00
Interest on Bank Balances	60.00	8.20
Interest and Securities	100.00	135.00
Interest on Society Endowment	1,000.00	1,025.00
Surplus Fund	1,750.00	.....
	$38,160.00	$34,746.88

EXPENSES	Budget 1932	Actual 1932
Travel—Committee and Laboratory Personnel	$ 2,000.00	$ 887.75
Salary—Clerical, Society Headquarters	800.00	500.00
Salary—Technical Adviser	2,800.00	2,800.00
General Printing and Promotion	500.00	10.51
Correlating Thermal Research	500.00	500.00
A. S. H. V. E. Laboratory (Pittsburgh)		
Salaries	$15,000.00	$12,449.16
Laboratory Supplies and Equipment	1,500.00	571.71
Office Supplies and Expense	750.00	845.41
Meetings	200.00	67.25
Contracts with Cooperating Institutions	13,175.00	12,789.50
Emergency Fund (For use as directed by Committee on Research)	935.00	.....
	$38,160.00	$31,421.29
Cleveland Exposition	.....	432.34
Dispersed for Res. Lab. by Soc. Hdq. Off. 1931	.....	850.00
Total Expense	$38,160.00	$32,703.63

1932 Research Contributors

American Oil Burner Association
Copper and Brass Research Association
Heating and Piping Contractors National Association
National Association of Fan Manufacturers
National Association of Ice Industries
Ventilating Contractors Employers Association
Aerofin Corporation
American Air Filter Company
American Blower Corporation
American Radiator Company
Barber-Colman Company
Barnes and Jones
Brundage Company
Buckeye Blower Company
A. M. Byers Company
Buffalo Forge Company
Bush Manufacturing Company
W. H. Carrier
Carrier Engineering Corporation
Celotex Company
Clarage Fan Company
Crane Company
Detroit Edison Company
Detroit Stoker Company
C. A. Dunham Company
Frigidaire Corporation
Garden City Fan Company
General Electric Company
Hart and Hutchinson Company
Hoffman Specialty Company
Holtzer-Cabot Electric Company
Howard Iron Works and Alberg Heater Company
Ilg Electric Ventilating Company
Illinois Engineering Company
Johns-Manville Corporation
Johnson Service Company
Leeds and Northrup Company
Modine Manufacturing Company
Minneapolis-Honeywell Regulator Company
Nash Engineering Company
National Radiator Corporation
National Regulator Company
National Tube Company
Herman Nelson Corporation
J. J. Nesbitt, Inc.
New York Blower Corporation
Owens-Illinois Glass Company
Peerless Unit Ventilation, Inc.
Petroleum Heat and Power Company
Powers Regulator Company
Reliable Plumbing and Heating Company
Smithsonian Institution
B. F. Sturtevant Company
Trane Company
United Engineers and Constructors
United States Radiator Corporation
Warren Webster and Company
Westinghouse Electric and Manufacturing Company
Youngstown Sheet and Tube Company

Presented at the 39th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Cincinnati, Ohio, January 1933.

*Original budget adopted January 27, 1932.

Research Activities

The Committee on Research gave consideration during 1932 to 14 research projects. While it was impossible to investigate each subject in the laboratory, a Technical Advisory Committee studied each project with a view of determining its needs and of cooperating with the Chairman of the Committee on Research and the Director of the Research Laboratory in developing plans for research to be carried on in the laboratory at Pittsburgh and in the cooperating universities. The fourteen Technical Advisory Committees, each made up of authorities on the particular subjects, brought to the active support of the Society's research activity the combined experience and ability of 88 engineers, educators and scientists. During 1932 Prof. A. C. Willard continued as Technical Advisor to the Committee on Research.

Cooperating Universities

The practice of augmenting the work carried on at the Society's laboratory in Pittsburgh through cooperative arrangements with engineering departments of educational institutions was continued. The following is a list of institutions which cooperated with the Laboratory in 1932 and the projects under investigation by them:

UNIVERSITY OF WISCONSIN: Aeration of buildings and allied subjects.

ARMOUR INSTITUTE OF TECHNOLOGY: Study of air flow through registers and grilles and performance of unit ventilators.

CARNEGIE INSTITUTE OF TECHNOLOGY: Study of capacity of pipe for steam heating systems.

UNIVERSITY OF ILLINOIS: Direct and indirect radiation with gravity air circulation. Also cooling of buildings.

UNIVERSITY OF KANSAS: Garage ventilation.

HARVARD SCHOOL OF PUBLIC HEALTH: Ionization of air and its health significance.

YALE UNIVERSITY: Study of oil burning devices.

UNIVERSITY OF MINNESOTA: Transmission of heat through building construction and allied subjects.

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS: Flow of water in hot water heating systems and allied subjects.

Papers Published Since the 1932 Annual Meeting

As a result of the activities of the Technical Advisory Committees, 15 papers were prepared for presentation at either the 1932 Summer Meeting or the 1933 Annual Meeting of the Society. Each of these papers added something to the fundamental technical knowledge of the heating, ventilating and air conditioning branches of the engineering profession. These papers are:

Thermal Properties of Building Materials, by F. B. Rowley and A. B. Algren. (*Heating, Piping and Air Conditioning,* May, 1932). Presented at the Semi-Annual Meeting, June 1932.

Natural Wind Velocity Gradients Near a Wall, by J. L. Blackshaw and F. C. Houghten. (*Heating, Piping and Air Conditioning,* June 1932). Presented at the Semi-Annual Meeting, June 1932.

How to Use the Effective Temperature Index and Comfort Charts, by C. P. Yaglou, Dr. E. V. Hill, F. C. Houghten and J. H. Walker. (*Heating, Piping and Air Conditioning,* June 1932). Presented at the Semi-Annual Meeting, June 1932.

Investigation of Air Outlets in Class Room Ventilation, by G. L. Larson, D. W. Nelson and R. W. Kubasta. (*Heating, Piping and Air Conditioning,* June and July 1932). Presented at the Semi-Annual Meeting, June 1932.

Loss of Head in Copper Pipe and Fittings, by F. E. Giesecke and W. H. Badgett. (*Heating, Piping and Air Conditioning,* June 1932). Presented at the Semi-Annual Meeting, June 1932.

Carbon Monoxide Distribution in Relation to the Ventilation of a One-Floor Garage, by F. C. Houghten and Paul McDermott. (*Heating, Piping and Air Conditioning,* July 1932). Presented at the Semi-Annual Meeting, June 1932.

Carbon Monoxide Distribution in Relation to the Ventilation of an Underground Ramp Garage, by F. C. Houghten and Paul McDermott. (*Heating, Piping and Air Conditioning* August 1932). Presented at the Semi-Annual Meeting, June 1932.

Test of Convectors in a Warm Wall Testing Booth, by A. P. Kratz, M. K. Fahnestock and E. L. Broderick. (*Heating, Piping and Air Conditioning,* July 1932). Presented at the Semi-Annual Meeting, June 1932.

Study of the Application of Thermocouples to the Measurement of Wall Surface Temperatures, by A. P. Kratz and E. L. Broderick. (*Heating, Piping and Air Conditioning,* September 1932). Presented at the Annual Meeting, January 1933.

Flow of Condensate and Air in Steam-Heating Returns, by F. C. Houghten and Carl Gutberlet. (*Heating, Piping and Air Conditioning,* December 1932). Presented at the Annual Meeting, January 1933.

Air Supply and Its Effect on Performance of Oil Burners and Heating Boilers, by L. E. Seeley, J. H. Powers and E. J. Tavanlar. (*Heating, Piping and Air Conditioning,* December 1932). Presented at the Annual Meeting, January 1933.

Condensate and Air Return in Steam Heating Systems, by F. C. Houghten and J. L. Blackshaw. Presented at the Annual Meeting, January 1933.

Study of Summer Cooling in the Research Residence at the University of Illinois, by A. P. Kratz and S. Konzo, and Summer Cooling Operating Results in a Detroit Residence, by J. H. Walker and G. B. Helmrich. Presented at the Annual Meeting, January 1933, and published in *Heating, Piping and Air Conditioning.*

Cold Walls and Their Relation to Feeling of Warmth, by F. C. Houghten and Paul McDermott. (*Heating, Piping and Air Conditioning,* January 1933). Presented at the Annual Meeting, January 1933.

Research Projects Considered During 1932

Each of the 14 research projects under consideration by the 14 Technical Advisory Committees are discussed in detail under the subject headings and the personnel of the committees.

1. INFILTRATION IN BUILDINGS

TECHNICAL ADVISORY COMMITTEE: J. G. Shodron, *chairman,* J. E. Emswiler, F. E. Giesecke, D. W. Nelson, W. C. Randall, Ernest Szekely, J. H. Walker, M. S. Wunderlich.

The general subject of aeration of buildings has been investigated by the Research Laboratory and cooperative universities for the past several years. During the past year the project has been continued at the University of Wisconsin in cooperation with the Society under the direction of Prof. G. L. Larson, chairman of the Mechanical Engineering Department of the University. The Technical Advisory Committee has outlined a number of phases of the general study still to be investigated.

Tests on the influence of outlet vents were reported at the June 1932 Meeting of the Society in a paper entitled, Investigation of Air Outlets in Class Room Ventilation, by G. L. Larson, D. W. Nelson and R. W. Kubasta. (See *Heating, Piping and Air Conditioning,* June and July 1932).

A study of air stratification in confined spaces and the effect of crowds and air movement has been carried on for the last two winters in the new University Field House. Many series of temperature readings have been taken under various conditions of air circulation. Resistance thermometers are placed at 10-ft intervals from the floor to roof. Records of relative humidities have also been taken. The results without fan circulation show a fairly large temperature gradient in the first 25 ft and a much smaller gradient in the last 75 ft. The system is designed in such a way that the fan circulation reduces the temperature gradient to a very low amount.

2. AIR FLOW THROUGH REGISTERS AND GRILLES

TECHNICAL ADVISORY COMMITTEE: John Howatt, *chairman,* J. J. Aeberly, C. A. Booth, L. E. Davies, D. E. French, J. J. Haines.

The work on air flow through registers and grilles has been given consideration by the Technical Advisory Committee during the past year and work has been carried on by Prof. L. E. Davies at Armour Institute of Technology in cooperation with the Society. The work has been directed along two definite lines: first, the study of methods for the measurement of air flow through registers and grilles when being supplied to or exhausted from rooms; and second, the study of methods of determining air delivery by unit ventilators.

3. PIPE AND TUBING CARRYING LOW PRESSURE STEAM OR HOT WATER

TECHNICAL ADVISORY COMMITTEE: S. R. Lewis, *chairman,* J. C. Fitts, F. E. Giesecke, H. M. Hart, A. P. Kratz, C. A. Hill, R. R. Seeber, W. K. Simpson.

The study of pipe capacities for steam and hot water heating systems has been under investigation by the Laboratory for the past several years. The work on pipe sizes for steam heating systems was carried on by the Laboratory at the Carnegie Institute of Technology in cooperation with the latter institution.

These studies have resulted in the papers, Flow of Condensate and Air in Steam Heating Returns, by F. C. Houghten and Carl Gutberlet (see *Heating, Piping and Air Conditioning,* December 1932), and Condensate and Air Return in Steam Heating Systems, by F. C. Houghten and J. L. Blackshaw.

The study of the carrying capacity of pipe in hot water heating systems has been investigated by Prof F. E. Giesecke, Director of the Experiment Station of the Texas Agricultural and Mechanical College in cooperation with the Society. This investigation has been under way for some time, resulting in a number of publications.

4. GAS HEATING EQUIPMENT

TECHNICAL ADVISORY COMMITTEE: W. E. Stark, *chairman,* R. M. Conner, Robert Harper, Thomson King, F. B. Howell, E. A. Jones, Henry Loebell, J. F. McIntire, L. S. Ourusoff, H. L. Whitelaw.

The Technical Advisory Committee on Gas Heating Equipment was organized during the present year and has undertaken a survey of the work to be carried on by the Laboratory. In this connection the committee has proposed a program including the following: (1) a study of the value of automatic draft adjusters on gas boilers with an estimate of the fuel saving that

may be expected from their use; (2) a study of the loss of heat through draft hoods under normal gas house heating operating conditions.

5. SOUND IN RELATION TO HEATING AND VENTILATION

TECHNICAL ADVISORY COMMITTEE: Warren Ewald, *chairman*, Carl Ashley, C. A. Booth, V. O. Knudsen, R. F. Norris, J. P. Reis, G. T. Stanton.

The Technical Advisory Committee on this subject has studied the needs of the problem during the current year but have not yet presented a comprehensive plan for laboratory research. The problem is a new one as far as the Society's research activity is concerned, and will no doubt prove a fruitful field of investigation for the future.

6. DIRECT AND INDIRECT RADIATION WITH GRAVITY AIR CIRCULATION

TECHNICAL ADVISORY COMMITTEE: H. F. Hutzel, *chairman*, R. M. Conner, R. E. Daly, R. V. Frost, J. H. Holton, A. P. Kratz, J. F. McIntire, W. T. Miller, R. N. Trane, O. G. Wendel.

The study of direct and indirect radiation was given consideration by the Technical Advisory Committee during the year and the investigation of the subject under the direction of Prof. A. C. Willard was made at the University of Illinois in cooperation with the Society. The subject has been broadened to include other phases related to direct and concealed radiation with gravity air circulation. In addition to the fully equipped room heating testing plant previously provided by the University, the latter has, during the past year, provided the recording and measuring instruments required for the operation of an eupatheoscope.

The investigation since January 1, 1932, has proceeded with three principal objectives: (1) The continuation of the study of the performance characteristics of different types of convectors when subjected to the actual service environment furnished by the room heating testing plant; (2) a study of the performance of convectors in the warm wall testing booth as provided for in the A. S. H. V. E. Standard Code for Testing and Rating Concealed Gravity Type Radiation (Steam Code), for the purpose of testing the validity of the correction factor used to convert the actual heat output under test conditions to the equivalent heat output under standard conditions (steam at 215 F and inlet air at 65 F); (3) a correlation of the performance of convectors in the warm wall booth with the performance in the room heating testing plant.

The published results of the entire investigation to date appear in three Bulletins, Nos. 169, 192 and 223, and one Reprint, No. 1, of the Engineering Experiment Station of the University of Illinois, and in six professional papers presented before the Society. The three papers appearing since January 1, 1932, are:

Performance of Convector Heaters, presented at the Annual Meeting of the Society, January 1932, and published in *Heating, Piping and Air Conditioning*, April 1932.

Tests of Convectors in a Warm Wall Testing Booth, presented at the Semi-Annual Meeting of the Society, June 1932, and published in *Heating, Piping and Air Conditioning*, July 1932.

Study of the Application of Thermocouples to the Measurement of Wall Surface Temperatures, presented at the Annual Meeting of the Society, January 1933, and published in *Heating, Piping and Air Conditioning*, September 1932.

7. ATMOSPHERIC DUST AND AIR CLEANING DEVICES

TECHNICAL ADVISORY COMMITTEE: H. C. Murphy, *chairman*, J. J. Aeberly, J. J. Bloomfield, Albert Buenger, Philip Drinker, Dr. E. V. Hill, H. B. Meller, Games Slayter, Perry West, Dr. S. W. Wynne.

The efforts of the Technical Advisory Committee during the past year have included laboratory investigations at the University of Minnesota and committee work which included the development of a code for testing air cleaning devices. The Technical Advisory Committee has cooperated with a national committee representing several other societies and associations interested in the dust problem. The general aim of this combined national committee is to develop a comprehensive study of the entire dust and smoke abatement, to promote general recognition of the problem by the public, and further the organization of means for alleviating the smoke and dust nuisance.

In the work at the University of Minnesota which is a cooperative project sponsored by the Society and the *National Warm Air Heating Association*, it has been necessary first to do a considerable amount of experimental work to determine the practicability of a proposed test code. Some of the difficulties were to obtain uniform distribution of dust, to select an acceptable type of dust, and to agree upon a method of determining the efficiency. In this work, the test apparatus has been set up, the provisions of a test code have been checked, and the code has now been submitted.

Active cooperation has also been enjoyed by the committee with the Pure Air Committee of the *American Society of Mechanical Engineers*. The aim of this cooperation has been to coordinate all smoke abatement efforts throughout the country. Further cooperation has been carried on between the committee and other organizations, including Government Bureaus, and the Research Hospital of the University of Illinois at Chicago, where the effect of air impurities on certain allergic disorders, such as seasonal hay fever and bronchial asthma, has been investigated. The report of the investigations of the Research Hospital for the year was published in the May 1932 *Journal of the American Medical Association*. The results of this year's investigations were reported in a paper presented before the meeting of the Chicago Allergy Society and will be published in the *Journal of the American Medical Association* at a future date by Dr. Welker.

8. VENTILATION OF GARAGES AND BUS TERMINALS

TECHNICAL ADVISORY COMMITTEE: E. K. Campbell, *chairman*, T. M. Dugan, E. C. Evans, L. A. Harding, F. H. Hecht, V. W. Hunter, F. C. McIntosh, H. Lee Moore, A. H. Sluss.

The study of garage ventilation and the elimination of carbon monoxide from such establishments has received the attention of the Technical Advisory Committee during the past two years. The needs of the problem were originally brought to the attention of the Laboratory through the development of a code for the heating and ventilation of garages by the *National Fire Protection Association* in 1929 in cooperation with other interested organizations, including the Society.

Complete plans for the study were outlined by the Committee early during 1932, which included (1) a study of the ventilation of an underground ramp garage in a 40-story office building in Pittsburgh; (2) a study of the ventilation of a small one-story single room garage in Pittsburgh; and (3) a study of the ventilation of a garage in Lawrence, Kansas, by Prof. A. H. Sluss at the University of Kansas in cooperation with the Research Laboratory. These investigations were carried out during the early part of the year, resulting in the papers: Carbon Monoxide Distribution in Relation to the Ventilation of a One-Floor Garage, published in the July 1932 issue of *Heating, Piping and Air Conditioning*, and Carbon Monoxide Distribution in Relation to the Ventilation of an Underground Ramp Garage, published in the August 1932 issue. Both papers were presented at the Semi-Annual Meeting of the Society in June 1932.

9. AIR CONDITIONS AND THEIR RELATION TO LIVING COMFORT

TECHNICAL ADVISORY COMMITTEE: C. P. Yaglou, *chairman*, I. C. Baker, W. L. Fleisher, D. E. French, Dr. E. V. Hill, Dr. R. R. Sayers.

The Technical Advisory Committee has been active during the past year in carrying out plans for research previously developed. Laboratory work under this committee was conducted

during the year both at the Harvard School of Public Health under the direction of Prof. C. P. Yaglou and in cooperation with the Society, and at the Research Laboratory in Pittsburgh.

Cooperative research with Harvard is now being concentrated on subjective, physiologic, and biochemical effects of artificially ionized air, with the object of establishing whether or not artificial ionization definitely improves the quality of air, the conditions under which ionization may prove physiologically desirable or harmful, and the precautions to be taken in the application of ionization to conditioning air.

Plans for future work include a study of the minimum air requirements under sedentary conditions and, if finances permit, under conditions of muscular exercise also. The fundamental principles of the problem have been under investigation for the past two years at Harvard, and it is now proposed to apply these principles to large scale experiments in ordinary rooms for the purpose of checking the validity of the fundamental data under actual living and working conditions.

A study of the effect which cold walls have on the desired air temperature for feeling of comfort of a person in a room was made at the Laboratory in Pittsburgh and resulted in a paper, Cold Walls and Their Relation to Feeling of Warmth, presented at the Annual Meeting 1933 in Cincinnati. This investigation shows that the effect of cold inside walls resulting from normal building construction and normal outside air temperatures, while in some sense important, is not a tremendous factor, unless the wall is of poor construction and the outside temperature extremely low.

10. RE-STUDY OF COMFORT CHART AND COMFORT LINE

TECHNICAL ADVISORY COMMITTEE: C. P. Yaglou, *chairman*, W. H. Carrier, Dr. E. V. Hill, F. C. Houghten, J. H. Walker.

This is a new Technical Advisory Committee organized at the beginning of the year and charged with the specific task of reviewing all previous work by the Society's laboratory in the development of the Effective Temperature Scale and Comfort Chart. The committee did a considerable amount of work during the first half of the year, resulting in a complete and comprehensive summation of the entire series of investigations relating to the comfort zone and comfort line, which should accomplish a great deal in bringing about a uniform understanding of the entire subject on the part of the membership of the Society. This report, entitled, How to Use the Effective Temperature Index and Comfort Charts, was presented at the Semi-Annual Meeting of the Society last June, and was published in the June 1932 issue of *Heating, Piping and Air Conditioning*.

11. OIL BURNING DEVICES

TECHNICAL ADVISORY COMMITTEE: H. F. Tapp, *chairman*, P. E. Fansler, R. V. Frost, F. B. Howell, R. C. Morgan, L. E. Seeley.

The Technical Advisory Committee on Oil Burning Devices has been active throughout the year in following out the laboratory studies by Prof. L. E. Seeley of Yale University in cooperation with the Society. A paper entitled, Air Supply and Its Effect on Performance of Oil Burners and Heating Boilers, resulted from this activity. (See *Heating, Piping and Air Conditioning*, December 1932.) The Committee has also been active in formulating new plans for future laboratory work.

12. CORRELATING THERMAL RESEARCH

TECHNICAL ADVISORY COMMITTEE: R. M. Conner, *chairman*, D. S. Boyden, P. D. Close, J. C. Fitts, W. T. Jones, H. T. Richardson, Perry West.

The Technical Advisory Committee on Correlating Thermal Research was active during the past year in the perfecting of the organization and promotion of the work under the auspices of the Research Laboratory. Formerly this work was carried on by a separate association which has now disbanded. A directory was prepared and distributed during the year, and the work of cataloging the available literature was continued.

13. REFRIGERATION IN RELATION TO AIR TREATMENT

TECHNICAL ADVISORY COMMITTEE: A. P. Kratz, *chairman*, E. A. Brandt, G. B. Bright, S. R. Lewis, H. J. Macintire, E. D. Milener, F. G. Sedgwick, A. R. Stevenson, Jr., J. H. Walker, R. W. Waterfill, A. C. Willard, A. W. Williams, H. M. Williams.

This is a new project undertaken by the Committee on Research during the past year. The Technical Advisory Committee was organized in the spring. A Sub-Committee of the Technical Advisory Committee met in Columbus, Ohio, in May and outlined a program of research to be carried on at the Research Residence of the University of Illinois in cooperation with the Society. This program was later approved by the entire Technical Advisory Committee. A paper entitled, Study of Summer Cooling in the Research Residence at the University of Illinois, by A. P. Kratz and S. Konzo, resulted from this investigation.

A coordinated study of the same subject was also made during the summer by J. H. Walker and G. B. Helmrich of the Detroit Edison Company in cooperation with the Laboratory. A paper entitled, Summer Cooling Operating Results in a Detroit Residence, resulted from this work.

For the purpose of this investigation, the *National Warm Air Heating Association* also cooperated by providing the use of the Research Residence and other services.

14. HEAT TRANSMISSION

TECHNICAL ADVISORY COMMITTEE: L. A. Harding, *chairman*, A. B. Algren, R. E. Backstrom, A. H. Barker, A. E. Stacey, Jr., J. H. Walker.

The subject of heat transmission has been under investigation since the organization of the Laboratory and a great number of papers on this subject have been published. Based on these papers, the section on heat loss from buildings in THE GUIDE has been greatly improved and developed. These investigations have included heat flow measurements in actual buildings made with the Nicholls' Heat Flow Meter developed at the Laboratory, effect of aging on the conductivity of concrete, and the effect of heat capacity and solar radiation on heat flow in a building, at the Laboratory. A study of film conductance coefficients for various surfaces in still and moving air was made at both the Laboratory and the University of Minnesota. Studies were also made of heat flow through built-up wall panels and insulating and building materials, and of the insulating effect of air spaces at the University of Minnesota in cooperation with the Laboratory.

Ventilation Code Committee

Since invitations were sent out by the *American Standards Association*, 40 organizations have indicated their interest in the work of the Ventilation Code Committee now being organized. This work, to be conducted under *A. S. A.* procedure, is sponsored by the A. S. H. V. E. and to date 23 associations and government bureaus have named representatives for membership on the Sectional Committee.

Proceedings of the 39th Annual Meeting

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Cincinnati, Ohio, January 23 to 25, 1933

OUTSTANDING in the record of the 39th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS held at the Hotel Gibson, Cincinnati, January 23-25, were these notable facts: the intense interest in the subject matter of the technical papers and reports, the prompt adoption of the Revised Constitution and By-Laws, the action taken to create a committee to modernize nomenclature on heat output, and the large registration and attendance at all meetings and social functions.

FIRST SESSION—

Monday, January 23, 1933, 9:30 A. M.

President F. B. Rowley, Minneapolis, declared the 39th Annual Meeting of the Society in session at 9:30 A. M. Monday, January 23, at the Hotel Gibson, Cincinnati, Ohio.

Kenneth A. Wright, President of the Cincinnati Chapter, expressed his appreciation for the opportunity which the local members had, to entertain the Society and then presented the Honorable Anthony B. Dunlap, a member of the City Council, who welcomed the Society members and guests to Cincinnati. A brief and fitting response was made by President Rowley.

The first item of business was the report of Council which was read by the Secretary.

Report of Council

During the year 1932, the Council held five regular meetings. The organization meeting was held in Cleveland, Ohio, at the conclusion of the 38th Annual Meeting, January 29, with President Rowley presiding. A. V. Hutchinson was appointed Secretary and the personnel of the four Council Committees was announced and confirmed by vote of the Council. Eight special committees were appointed.

The budget for 1932 as proposed by the Finance Committee was adopted providing for an estimated income of $83,420.00, an expenditure of $75,180.00 for all Society activities except Research.

At the April Meeting in Pittsburgh a vacancy in the Committee on Research was filled by the appointment of F. C. McIntosh to serve during 1932. A Charter was granted for the formation of a Chapter in Cincinnati and a future schedule of Society meetings was discussed. Plans for the Semi-Annual Meeting 1932 in Milwaukee were approved.

During the June Meeting in Milwaukee a Charter was granted for the formation of a Student Chapter at the New York University. The budget was revised and a report from the Committee on Revision of Constitution and By-Laws was received. The publication of Transactions 1931 was deferred and a resolution was adopted proposing a reduction in dues for 1933 and 1934. Candidates were nominated for Committee on Research and a plan was proposed for the investigation of members delinquent on dues.

In September the Council met in Buffalo, New York, and received the report of the Committee on Revision of Constitution and By-Laws and authorized its preparation for final submission to the membership. The matter of membership and Society finances were discussed in detail.

On November 21 the Council met in New York and authorized the plan of limited chapter membership for the Massachusetts Chapter and Kansas City Chapter. Printing and distribution of the report of the Committee on Constitution and By-Laws was authorized so that action could be taken at the Annual Meeting in January, 1933.

The Council set the dues for 1933 on the following schedule: Members and Associates $18; Juniors $10; Students $3 and waived Initiation Fees for those elected during 1933.

The program for the 39th Annual Meeting in Cincinnati was approved.

During the year routine action was taken in the granting of Life Membership to 15 members; reinstatement of 8 members; acceptance of 121 resignations and cancellation of 142 memberships for non-payment of dues.

The report of the Committee on Increase of Membership was given by R. H. Carpenter, Chairman, as follows:

Report of Committee on Increase in Membership

The new Membership Drive, like everything else, suffered from existing business conditions during the year 1932. The methods followed by the Committee this year were somewhat different from those in existence previously. The results, while falling far short of the goal set by the Committee, may be considered fair nevertheless.

A total of 117 applications was acted upon by the Council during the calendar year, of which 100 represents new members of various grades. The classification of same is as follows:

NEW APPLICATIONS		ADVANCEMENTS		RE-INSTATEMENTS	
Members	47	Members	9	Members	7
Associates	20			Associates	1
Juniors	15				
Students	18				
	100				

Respectfully submitted,
R. H. CARPENTER, *Chairman*,
Committee on Increase in Membership.

John Howatt, Chairman of the Finance Committee, gave a summary of the financial condition of the Society.

Report of the Finance Committee

The year 1932 was a year in which all corporations, societies and individuals that operated on a budget system experienced a shrinkage in revenue beyond that anticipated. The most pessimistic prophecies made at the beginning of 1932 proved to be the most nearly correct. The experience of our Society was no different than that of other organizations. We prepared a budget at the beginning of the year, based upon what was at the time considered to be a reasonable reduction in revenue below that of 1931. By mid-year, however, it was evident that our anticipated revenues were not to be obtained, so at the summer meeting in Milwaukee, your Finance Committee prepared and had approved by the Council, a revised budget which greatly curtailed expenditures for the balance of the year. The expenses of the Society were maintained within the revised budget provi-

sions and the year closed without a budget deficit. The shrinkage in both revenues and expenditures for the year 1932 as compared with 1931 was approximately 25 percent.

As required by our Constitution and By-Laws, an examination of our funds and audit of our accounts was made by a Certified Public Accountant for the year ending December 31, 1932. A copy of his report is filed with the Secretary and may be examined by any member of the Society. The main points of interest in this report are as follows:

(1) There was cash on deposit in the various Society Funds totaling $10,280.34, on December 31, 1932.

(2) The Society owns securities of a par value of $36,000 which cost the Society $35,680.67 but which have a present market value of $20,272.50, a shrinkage of $15,408.17 or 43%. Up to date there has been no default in the interest payment on any security held by the Society.

(3) The General Fund, or Capital of the Society decreased from $34,224.87 to $32,823.93 during the year, due to a paper loss of $2,356.53 reported by the Auditor in all Society activities.

(4) The accounts receivable as of date December 31, 1932, were $28,513.84 consisting mainly of unpaid members' dues for 1930, 1931 and 1932, and monies due on advertising in the Guide and on sales of Guide copies.

(5) The accounts payable consist of $11,631.24, principally monies due on the production of the 1933 Guide and which will be paid out of the receipts from advertisements in the same Guide, and the sum of $7,500 00 set up as a contingent liability for the production of the 1931 and 1932 TRANSACTIONS. The total of accounts payable is $22,271.11 as contrasted with accounts receivable of $28,513.84.

(6) The gross income to the Society from all sources was $64,944.00 in 1932. The total expenses as shown by the Auditor were $67,300.53. This latter figure, however, includes an item of $3,500.00 for 1931 TRANSACTIONS which was not budgeted and on which nothing was actually spent, the sum of $1,357.21 to cover the loss on 1930 TRANSACTIONS, a loss carried over from previous years, and the sum of $1,500.00 set up as a possible loss in collection on advertising contracts. The Budget was followed closely throughout the year and the year closed without a Budget deficit.

Your Finance Committee has estimated the gross income for the Society for 1933 at approximately $54,000. In order to live within this income it will be necessary to again call on the employes at the Headquarters Office to operate on a reduced income basis, to reduce salaries, to reduce rent for office space and to curtail some of the Society activities. It is the sincere hope of the Committee that this is the last year in which your Finance Committee will be required to prepare a Budget based upon a reduced income or one that will show any serious curtailment of Society activities.

JOHN HOWATT, *Chairman.*
Finance Committee.

Report of Certified Public Accountant

January 8, 1933.

AMERICAN SOCIETY OF HEATING AND
VENTILATING ENGINEERS,
51 MADISON AVE.,
NEW YORK CITY.

Gentlemen:

Pursuant to your request I made an examination of the books of account and records of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—NEW YORK CITY, for the Year Ended December 31, 1932, and submit herewith my report.

The work covered a verification of the Assets and Liabilities as of the date previously stated and a review of the operating accounts for the Calendar Year 1932.

Submitted herewith is a Balance Sheet showing the financial condition of the Society on December 31, 1932, and your attention is directed to the following comments thereon:

CASH

Cash on Deposit was verified by direct communication with the banks listed below and by reconcilement of the amounts reported to me with the balances shown by the books of the Society.

SOCIETY

BANKS	AMOUNT
Chase National Bank (Special)	$1,092.75
Chase National Bank (Regular)	1,433.41
Bankers Trust Company	1,581.66
Bowery Savings Bank (Book No. 57,001)	935.99
Emigrant Industrial Savings Bank (Book No. 141,682)	1,411.31
Bank of United States in Liquidation No. 19,905	500.00
	$6,955.12

FUNDS

F. PAUL ANDERSON AWARD		
Bank for Savings (Book No. 1,326,641)	$ 706.04	
Bank of United States in Liq. No. 19,905	185.56	891.60
RESEARCH		
Bankers Trust Company	1,852.35	
Forbes National Bank, Pittsburgh, Pa	24.03	1,876.38
RESEARCH ENDOWMENT FUND		
Bank for Savings (Book No. 1,326,640)	$ 282.81	
Bank of United States in Liq. No. 19,906	274.43	557.24
TOTAL		$10,280.34

Cash on Hand for Deposit was verified by inspection of the checks or of the record made of Cash Receipts subsequent to December 31, 1932.

The Petty Cash at New York was verified by count.

MARKETABLE SECURITIES

There is attached hereto a schedule of negotiable bonds which were verified by direct communication with the Bankers Trust Company where same are deposited for safekeeping. No adjustment has been made of the $15,408.17 shrinkage in the market value of these securities. These have been included in the attached Balance Sheet at cost.

ACCOUNTS RECEIVABLE

Unpaid membership dues were determined by trial balance of the individual ledger cards and aging of the unpaid charges which may be summarized below:

1932 Unpaid Dues	$18,390.00
1931 Unpaid Dues	6,923.55
1930 Unpaid Dues	616.00
TOTAL	$25,929.55

My verification of the dues disclosed that during the year 1932 there had been prepaid to the Society dues amounting to $304.97 which sum I have shown on the attached Balance Sheet as deferred income.

The Reserve found on the books to cover probable losses which may result from prior years' dues was found ample. In addition, however, I have provided the sum of $12,657.38, which will increase the reserve to seventy-five (75%) percent of the total dues outstanding. Adequate reserves have also been provided to cover losses which may be incurred during the realization of all other Accounts Receivable.

INVENTORIES

All TRANSACTIONS on hand for the years 1925 to 1930, inclusive, were inventoried and priced at cost.

TRANSACTIONS covering the year 1931, volume 37, and the year 1932, volume 38, were not published up to the close of the current year, therefore reserves of $4,000.00 and $3,500.00, respectively, have been provided to cover the future cost thereof.

All other Inventories were verified either by actual count or analysis of the records.

ACCOUNTS PAYABLE

On December 31, 1932, there remained unpaid invoices amounting to $11,631.24, of which $11,320.39 was owing on account of the Guide and Year Book printing costs.

DUE RESEARCH LABORATORIES

Of the dues charged to Members and Associates, forty (40%) percent has been reserved for the Research Laboratories in accordance with Section 5, Article 3, of the By-Laws. The sum payable to the Research Laboratory as and when the dues receivable will have been realized in cash is $2,634.94. An analysis of the amount due the Research Laboratories follows:

Dues	$2,634.94	
Interest from Endowment Fund Securities	1,025.00	$ 3,659.94
Clerical Salaries and Custodian's Fee chargeable to Research		825.00
Balance Due Research		$ 2,834.94

GENERAL FUND

An analysis of the General Fund of the Society showing the changes made during the year under audit follows:

GENERAL FUND—January 1, 1932—PER FORMER REPORT		$34,224.87
ADDITION		
Expenses of the Committee on Research previously absorbed by the Society		955.59
		$35,180.46
DEDUCTIONS		
Loss from Society Activities for the Calendar Year 1932 from Society Statement of Income and Expenses	$ 180.01	
Loss from Guide for the Calendar Year 1932 from Guide Statement of Income and Expenses	2,176.52	2,356.53
GENERAL FUND—DECEMBER 31, 1932—PER BALANCE SHEET		$32,823.93

MEMBERSHIP

A comparison of the membership in force as of the close of business December 31, 1931 and 1932, respectively, follows:

Classification	1932	1931	Increases Decreases
Members	1403	1539	136
Associates	424	490	66
Juniors	167	203	36
Students	44	22	22
Honorary	2	2	..
Life	27	25	2
	2067	2281	214

RESEARCH LABORATORIES

In accordance with Council Minutes the annual report of the Research Laboratories, which in prior years was rendered under separate cover, has been bound herein.

Respectfully submitted,

FRANK G. TUSA,

CERTIFIED PUBLIC ACCOUNTANT.

BALANCE SHEET

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

For the Year Ended December 31, 1932

ASSETS

SOCIETY				
CASH				
On Deposit		$ 6,955.12		
On Hand		100.00	$ 7,055.12	
INVESTMENTS (AT COST)				
Securities (Market Value $9,917.50)		12,919.49		
ADD: Accrued Interest		78.75	12,998.24	
ACCOUNTS RECEIVABLE				
Membership Dues	$25,929.55			
LESS: Reserve for Doubtful	19,493.66	6,435.89		
Advertisements	22,537.05			
LESS: Reserve for Doubtful	1,379.43	21,157.62		
Other	1,020.33			
LESS: Reserve for Doubtful	100.00	920.33	28,513.84	
INVENTORIES				
Transactions 1925-1930		2,408.63		
Emblems and Certificate Frames		72.80		
Postage		445.00		
Stationery, Printing and Office Supplies		289.00	3,215.43	
PERMANENT				
Library		300.00		
Furniture and Fixtures	5,215.46			
LESS: Reserve for Depreciation	2,736.35	2,479.11	2,779.11	
DEFERRED CHARGES				
Meetings 1933		33.30		
Chapter Meetings Allowance		500.00	533.30	$55,095.04
SPECIFIC FUNDS				
ENDOWMENT FUND				
Securities at Cost (Market Value $7,775.00)		19,753.68		
ADD: Accrued Interest		250.83	20,004.51	
F. PAUL ANDERSON AWARD FUND				
Cash on Deposit		891.60		
Cash on Hand for Deposit		152.34	1,043.94	
RESEARCH FUND				
Cash on Deposit—Research	1,876.38			
Cash on Hand for Deposit—Research	3,020.00			
Cash on Hand—Pittsburgh, Pa.	50.00			
Cash on Deposit—Research Endowment Fund	557.24			
Cash on Hand for Deposit—Research Endowment Fund	61.00	5,564.62		
Securities at Cost (Market Value $2,580.00)	3,007.50			
ADD: Accrued Interest	45.00	3,052.50	8,617.12	29,665.57
				$84,760.61

LIABILITIES AND CAPITAL

SOCIETY			
ACCOUNTS PAYABLE		$11,631.24	
DUE RESEARCH FUND		2,834.94	
RESERVE FOR TRANSACTIONS			
1931	$4,000.00		
1932	3,500.00	7,500.00	
DEFERRED INCOME			
Prepaid Dues		304.93	
		22,271.11	
TOTAL LIABILITIES			
GENERAL FUND			
Society		32,823.93	$55,095.04
SPECIFIC FUNDS			
Endowment		20,004.51	
F. Paul Anderson Award		1,043.94	
Research	7,998.88		
Research Endowment	618.24	8,617.12	29,665.57
			$84,760.61

NOTE "A" This Balance Sheet is subect to the comments contained in the letter attached to and forming a part of this report.

BUDGET COMPARISON—SOCIETY ACTIVITIES

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

NEW YORK CITY

For the Year Ended December 31, 1932

	Actual 1932	Budget Provision	Increases Decreases
INCOME			
Current Dues—Less Reserve	$21,358.95	$20,500.00	$ 858.95
Initiation Fees	970.00	1,100.00	130.00
Sales—Emblems and Certificate Frames	104.00	100.00	4.00
Sales—Codes	46.47	75.00	28.53
Sales—Journals, Reprints and Books	288.86	300.00	88.86
Sales—Transactions	386.25	500.00	113.75
Editorial Contract (Net)	11,127.36	11,000.00	127.36
Interest Earned—General Funds	620.00	300.00	320.00
Interest Earned—Current Funds	253.71	200.00	53.71
	$35,255.60	$34,075.00	$ 1,180.60
EXPENSES			
Salaries (Exclusive of Secretary)	$ 9,214.53	$ 9,500.00	$ 285.47
Postage	2,477.36	3,000.00	522.64
General Printing	836.32	700.00	136.32
Yearbook	725.00	900.00	175.00
Reprints, Books and Journals	267.78	200.00	67.78
Meetings	2,555.99	2,500.00	55.99
Meetings—Council, etc.	221.73	250.00	28.27
Traveling—President	734.92	900.00	165.08
Codes	722.44	400.00	322.44
Publicity	1,226.17	1,250.00	23.83
President's Emergency Fund	210.31	250.00	39.69
70% of Apportionable Expenses	11,175.38	11,893.00	717.62
	$30,367.93	$31,743.00	$ 1,375.07
UNBUDGETED EXPENSES			
Transactions—Prior Years	$ 1,357.21	.....	$ 1,357.21
Transactions—1932	3,500.00	.....	3,500.00
Engraving Certificates	100.35	.....	100.35
Emblems and Certificate Frames	110.52	.....	110.52
	$35,436.01	$31,743.00	$ 3,693.01
LOSS FOR THE YEAR	$ 180.41	$ 2,332.00	$ 2,512.41

NOTE "A" General Printing includes $287.84 expended to print the Constitution and By-Laws.

BUDGET COMPARISON—GUIDE

	Actual	Budget Provision	Increases Decreases
INCOME			
Advertising	$17,371.14	$29,000.00	$11,628.86
Sales	12,317.26	11,000.00	1,317.26
TOTALS	$29,688.40	$40,000.00	$10,311.60
EXPENSES			
Printing and Binding 1932 Issue	$ 8,834.15	$11,500.00	$ 2,665.85
Mailing 1932 Issue	2,679.62	2,500.00	179.62
Paper Purchases	1,553.27	2,400.00	846.73
Engraving and Art Work	428.60	500.00	71.40
Sales Promotion—Advertising	1,111.00	1,750.00	639.00
Sales Promotion—Copy Sales	3,137.56	4,000.00	862.44
Salaries (Exclusive of Secretary)	6,831.27	6,900.00	68.73
30% of Apportionable Expenses	4,789.45	5,097.00	307.55
TOTALS	$29,364.92	$34,647.00	$ 5,282.08
GUIDE PROFIT	$ 323.48	$ 5,353.00	$ 5,029.52
OTHER DEDUCTIONS			
Chapter Meeting Allowance	1,000.00	.....	1,000.00
Provision for Doubtful Accounts	1,500.00	.....	1,500.00
GUIDE LOSS	$ 2,176.52	$ 5,353.00	$ 7,529.52

RESEARCH LABORATORY OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—PITTSBURGH, PA.

For the Year Ended December 31, 1932

CASH RECEIPTS AND DISBURSEMENTS

BALANCE—JANUARY 1, 1932—PER FORMER REPORT			$ 7,049.58
RECEIPTS			
From the American Society of Heating and Ventilating Engineers	$16,795.92		
Contributions—Per Schedule	10,765.00		
Cleveland Exposition	5,012.76	$32,573.68	
Interest on Bank Balances	36.41		
Interest on Securities—Research	135.00		
Interest on Securities — Research Endowment Fund	1,025.00	1,196.41	33,770.09
			40,819.67
DISBURSEMENTS			
Salaries—Per Schedule		12,449.16	
Technical Adviser—Committee on Research		2,800.00	
Traveling—Executive Committee	556.99		
Traveling—F. C. Houghton	231.99		
Traveling—Staff	98.77	887.75	
Clerical—New York		800.00	
Laboratory Equipment and Supplies		571.71	
Correlating Thermal Research		500.00	
University Cooperation—Per Schedule		12,789.50	
Cleveland Exposition Exhibit		432.34	
Meetings		67.25	
OFFICE EXPENSES			
Stenographic Services (Committee)	162.25		
Postage	125.83		
Stationery and Printing	275.90		
Telephone and Telegraph	42.01		
Professional Services	100.00		
Expressage	66.60		
Miscellaneous	132.25	904.84	32,202.55
BALANCE—DECEMBER 31, 1932			$ 8,617.12

BUDGET COMPARISON

	Actual	Budget Provision	Increases Decreases
INCOME			
Dues—From the American Society of Heating and Ventilating Engineers	$16,795.92	$20,000.00	$ 3,204.08
Manufacturers	4,740.00	5,000.00	260.00
Associations	3,525.00	3,000.00	525.00
Exposition (Net)	5,012.76	2,250.00	2,762.76
Other Contributons	2,500.00	5,000.00	2,500.00
Interest on Bank Balances	36.41	60.00	23.59
Interest on Endowment Fund	1,025.00	1,000.00	25.00
Interest on Securities	135.00	100.00	35.00
Surplus Fund	—0—	1,750.00	1,750.00
	$33,770.09	$38,160.00	$ 4,389.91
EXPENSES			
COMMITTEE ON RESEARCH			
Travel — Committee and Laboratory Personnel	$ 887.75	$ 2,000.00	$ 1,112.25
Salary—Clerical, Society Headquarters, 1931	800.00	800.00	—0—
Salary—Technical Adviser	2,800.00	2,800.00	—0—
General Printing and Promotion	212.25	500.00	287.75
Correlating Thermal Research	500.00	500.00	—0—
	5,200.00	6,600.00	1,400.00
LABORATORY (PITTSBURGH)			
Salaries	12,449.16	15,000.00	2,550.84
Laboratory Supplies and Equipment	571.71	1,500.00	928.29
Office Supplies and Expense	692.59	750.00	57.41
Meetings	67.25	200.00	132.75
	13,780.71	17,450.00	3,669.29
CONTRACTS WITH COOPERATING INSTITUTIONS			
Contracts	12,789.50	13,175.00	385.50
Emergency Fund	—0—	935.00	935.00
EXPOSITION EXHIBIT	432.34	—0—	432.34
	13,221.84	14,110.00	888.16
	32,202.55	38,160.00	$ 5,957.45
	$ 1,567.54	$ —0—	$ 1,567.54

A report of the Secretary was given by A. V. Hutchinson which showed clearly the present condition of the Society.

Report of Secretary

The Society during 1932 carried on a record volume of activities and despite the drastic retrenchment program instituted, due to the reduction of revenue from dues and advertising, the major part of its contemplated program was carried out.

The TRANSACTIONS 1930 was distributed immediately after the Annual Meeting in Cleveland and several Codes were completed and sent to the members. These included:

A. S. H. V. E. Standard Code for Rating Steam Heating Solid Fuel Hand-Fired Boilers

A. S. H. V. E. Standard Code for Testing Steam Heating Boilers Burning Oil Fuel

A. S. H. V. E. Standard Code for Testing and Rating Concealed Gravity Type Radiation (Steam Code)

A. S. H. V. E. Standard Code for Testing and Rating Steam Unit Ventilators

Report of A. S. H. V. E. Committee on Ventilation Standards

These projects resulted from the untiring work of committees assigned to produce them, some of which have been working through a period of several years and have just completed their labors.

THE GUIDE 1933 was compiled with the cooperation of assistants among a widely scattered group of Society members working with the Guide Publication Committee, directed by Mr. Boyden. During the year the sale of copies of the 1932 edition was unusually heavy and exceeded the total of the previous year.

When it was decided to hold the 39th Annual Meeting in Cincinnati, the local group of members organized a Chapter and regular meetings were started during the Fall.

Earlier in the year the Students of New York University petitioned the Council for a Charter and a successful Student Chapter was organized and has the honor of being the first Student Section.

The majority of Chapters were visited by President Rowley, who carried to them an inspiring message on the value of Society membership, the importance of the Research projects, which it sponsors and the recognition that it has received through the compilation of THE GUIDE and its codes and standards.

The collection of dues presented a very difficult problem for the Finance Committee and revisions of the budget were necessary in the middle of the year. It should be noted, however, that the revised estimates of income and the actual expenditures were very accurate. With many members experiencing reduction of income and a considerable number suffering loss of employment, collection of dues has held up remarkably because of members' interest in and loyalty to the Society.

The effort to secure employment for members has continued and this has involved an unusually heavy correspondence at the Headquarters office. Recently an increasing inquiry for men trained in specialized phases of heating, ventilating and air conditioning has been noticeable.

Some loss of membership occurred during the past year and the present status of membership is 2,067, a reduction of 9 per cent from the peak reached in 1931. The loss by death has been unusually heavy and the total of 29 for 1932 equals the combined loss of the last 5 years.

Through the work of the Committee on Increase of Membership and the Council Members and Chapter Committees, a total of 117 men were elected during 1932. The present status of membership is as follows: Members 1,403, Associates 454, Juniors 137, Students 44, Life Members 27, Honorary Members 2.

The extra effort required to carry on the Society's work this year imposed by the financial conditions in the profession and industry, was supplied by the splendid energy and enthusiasm of my associates on the staff at the headquarters office. Each one ably met the daily assignments and gave extra hours without

compensation as the personnel was reduced to meet income. Their idea was to bring the Society through without impairment of the service. The year 1933 starts with a 50 per cent reduction in personnel and a proportionately reduced budget. There is, however, a definite indication of a widespread interest in Society activities and the need of the coming year is for every member to get a member, so that the organization can carry on the fine work that has won for it widespread recognition.

President Rowley announced the first technical paper of the session, entitled Study of the Application of Thermocouples to the Measurement of Wall Surface Temperatures by A. P. Kratz and E. L. Broderick, which presented the results of cooperative research at the University of Illinois. (Complete paper published in September, 1932, Journal.)

E. L. Broderick, Research Assistant at the University of Illinois, presented the paper in abstract. Among those who participated in the discussion were E. C. Evans, W. W. Timmis, Prof. H. B. Dirks, Dr. L. Greenberg, and Prof. F. B. Rowley. Answers to the questions asked in the discussion were supplied by Prof. A. P. Kratz.

Some Observations on Heating Practice by James Govan, was the title of the paper presented by the author. (Complete paper published in November, 1932, Journal.)

Questions were asked by Professor Kratz, Prof. A. I. Brown, and Mr. Timmis.

The report of the Committee on Research was presented by Prof. G. L. Larson of Madison, who reviewed the work of the Technical Advisory Committees and the research investigations carried on at the Society's Laboratory in Pittsburgh and cooperative institutions. (For Text of Report see page 165.)

Dr. C. A. Mills, Professor of Experimental Medicine, University of Cincinnati, offered some interesting comments on the relationship between the work of the physiologist, the physician, and the engineer. He explained that for the past five years he had conducted studies on the effects of varying and environmental conditions and said that there were strong indications that atmospheric environment determines the energy level of our existence, vigor, vitality, as well as our fertility of mind and body. He stressed the following three points: Atmospheric conditions can be specified which if applied to people of the tropical regions for a few hours each day would raise their energy level and do away with the traditional physical inertia. It would be exceedingly valuable to have complete air conditioning during summer heat waves as a means of saving many lives and speeding recovery of acute appendicitis cases. The application of cooling would be equally valuable for children with summer diarrhea, victims of heat exhaustion would also benefit greatly, and it is believed that by proper variation in completely controlled air the convalescence period could be shortened for many operations, fevers and obstetrical procedures.

The third point outlined by Dr. Mills, covered the apparent shift in the thought on air quantity requirements from the extreme views of the "fresh air fiend."

SECOND SESSION—

Monday, January 23, 1933, 2 P. M.

President Rowley called for the report of the Tellers of Election, which was given by Allen W. Williams, Chairman, as follows:

Report of Tellers

Your Board of Tellers wishes to report results of the vote for Officers and Council and members of the Committee on Research:

President: W. T. Jones 430
First Vice-President: C. V. Haynes 424
Second Vice President: John Howatt 431
Treasurer: D. S. Boyden 432
Members of the Council:
(Three Year Term)
R. H. Carpenter 430
J. D. Cassell 428
F. C. McIntosh 429
L. W. Moon 430
Members of the Committee on Research:
(Three Year Term)
Albert Buenger 432
S. H. Downs 432
H. N. Kitchell 432
H. R. Linn 431
Perry West 432
(One Year Term)
E. N. Sanbern 432
Total Ballots Cast 480
Disqualified 48

TELLERS OF ELECTION,
A. W. Williams, *Chairman*
R. J. Tenkonohy
A. W. Rooks

The paper resulting from cooperative research, entitled Air Supply and Its Effect on Performance of Oil Burners and Heating Boilers by L. E. Seeley, J. H. Powers, and E. J. Tavanlar, was given in abstract in the absence of the authors. (Complete paper published in December, 1932, Journal.)

President Rowley called upon W. T. Jones, Chairman of the Committee on Revision of Constitution and By-Laws. Mr. Jones explained the set-up of the new Constitution, By-Laws, and Rules and how it differed from the present Constitution and By-Laws. He pointed out that each member had received a copy and said that some valuable suggestions had been received. At the conclusion of Mr. Jones' analysis, a motion was made by D. S. Boyden, seconded by R. H. Carpenter, as follows:

Resolved that the report of the Committee on Revision of Constitution and By-Laws be adopted.

E. C. Evans, Pittsburgh, offered an amendment to the Constitution, Article IV, *Section* 1, in relation to the election of Council members. The Chair ruled that the proposed amendment was not in order as it related to the present Constitution and did not relate to the report of the Commmittee under discussion.

F. D. Mensing of Philadelphia, proposed an amendment to Article C-V of the Constitution as follows:

Section 1. The affairs of the Society shall be managed by a Board of Directors chosen from among the persons entitled to vote, which shall be styled *The Council.* It shall consist of the President, First Vice-President, Second Vice-President, Treasurer, the last Past President, and elected members equal in number to the number of chapters, one-third of whom shall be elected each year to hold office for three years. The Secretary may take part in the deliberation of the Council, but shall have no vote therein.

It was seconded by W. R. Eichberg.

R. H. Carpenter pointed out that the plan proposed gave no representation to Society members who were not members of the local chapters. E. H. Gurney, of

Toronto, expressed his opposition to the amendment because of the difficulties involved when the Society expands beyond its present size. Homer Linn, Chicago, also opposed the amendment.

C. A. Pickett, St. Louis, stated that he was in sympathy with the amendment, and also explained that having served as a member of the Nominating Committee, he felt that there would be no likelihood of discrimination against non-chapter members.

A rising vote on the amendment was taken and the Secretary reported the amendment lost.

The members present then voted on a motion to adopt the new Constitution as prepared by the Committee. The vote was overwhelmingly in favor.

F. D. Mensing presented a resolution as follows:

Resolved that the new By-Laws be accepted.

The motion was seconded by J. D. Cassell.

An amendment was offered to Article B-XI by John Howatt, Chicago. He proposed the addition of *Section 8*, as follows:

A Society Reserve Fund shall be created into which all admission fees and such other monies as the Council may direct shall be placed until the fund totals a sum equal to $15.00 per member. This Reserve Fund is to be used only in cases of emergency when current Society revenues are insufficient to pay necessary expenses. Withdrawals not to exceed 20% of the fund in any calendar year may be authorized by the Society at any meeting provided it has been recommended by the Council. Investments shall be made in accordance with Section I of Article B-XI. Interest earned on the Reserve Fund shall be added to current Society income.

His motion to adopt was seconded by J. D. Cassell, and was unanimously approved by vote of the members.

F. D. Mensing proposed the following revision of *Section* 1, Article B-XI, relating to funds:

When so directed by Council, the Chairman of the Finance Committee shall invest such portion of any funds of the Society as determined by the Council in securities of the United States Government. All such investment shall be approved by Council.

This was seconded by J. D. Cassell, and when presented for vote, was adopted unanimously.

In order that other Articles might conform, F. D. Mensing proposed the elimination from *Section 3*, Article B-XI, of the words, "legal for the investment of funds of savings banks of the State of New York provided by *Section* 1 and 2."

This motion was seconded by Homer Linn, Chicago, and approved.

W. T. Jones inquired if there were further amendments and then presented the motion to adopt the By-Laws as amended with the exception of Article B-IV and *Section* 10 of B-VIII. The motion was carried.

A motion was proposed by W. R. Eichberg, of Philadelphia, as follows:

Resolved that the Rules be adopted as written by the Committee.

The motion was seconded by J. D. Cassell and the vote of the members was in favor of adoption.

F. D. Mensing, Philadelphia, proposed the following motion:

Resolved that Appendix "A" of the Constitution, By-Laws, and Rules which are the Regulations Governing the Committee on Research, be adopted as written.

The motion was seconded by W. R. Eichberg and carried.

F. D. Mensing also proposed the following motion:

Resolved that Appendix "B," the Rules Governing the Award of the F. Paul Anderson Medal, be adopted as written.

This motion was seconded by J. D. Cassell and unanimously carried.

Chairman W. T. Jones announced that suggestions regarding dues and the style of the Nominating Committee were being prepared by the Advisory Council and that these matters would be taken up at a later session.

THIRD SESSION—
Tuesday, January 24, 1933, 9:30 A. M.

President Rowley called the meeting to order and introduced D. S. Boyden, Chairman of The Guide Publication Committee, who gave his report as follows:

Report of Guide Publication Committee

Of all the branches of the building industry, perhaps none has made greater strides and has had more changes with respect to equipment, practices and design procedures than heating and ventilation, and its special phase—air conditioning. Because of this fact, the A. S. H. V. E. Guide has been unique in the building field in that it has kept pace with these rapid changes and developments by being revised and brought up to date annually. It has thereby provided the industry with the latest available design data and information resulting from the research investigations of the Society and the practices of the outstanding authorities in this field.

The present issue, The Guide 1933, is no exception to this general policy of keeping The Guide up to date. In fact, more changes and new material are included in this issue than in any previous issue. Furthermore, The Guide 1933 contains 50 more pages of text matter and five more chapters than the next largest issue, its predecessor, The Guide 1932.

The Text Section includes 11 entirely new chapters, namely, Chapter 7, Radiant Heating; Chapter 12, Domestic Water Requirements; Chapter 21, Thermodynamics of Air Conditioning; Chapter 23, Mechanical Warm Air Heating and Air Conditioning Systems; Chapter 25, Central Fan Cooling and Air Conditioning Systems; Chapter 26, Cooling and Dehumidifying; Chapter 27, Refrigeration as Applied to Air Conditioning; Chapter 31, Control of Air Conditioning Systems; Chapter 32, Air Distribution within Enclosures; Chapter 34, Sound Control; and Chapter 37, Exhaust Systems.

In addition to the many new subjects introduced in these chapters, others have been extensively or completely revised, and practically none of the old copy was retained. Chapter 3, dealing with Transmission Losses, is almost entirely new and contains a completely revised set of tables of coefficients of transmission based on the latest researches of the Society at the University of Minnesota, and at the Laboratory in Pittsburgh. A large portion of the material in Chapter 14, Heating Boilers, has been replaced by more up-to-date information, and the chapter has been enlarged. One of the most important chapters of the present issue of The Guide is Chapter 22 dealing with Ventilation and Air Conditioning Standards for Comfort and Health, which has also been revised in the light of results obtained from recent researches at Harvard University and at the Laboratory of the Society in Pittsburgh. This chapter also includes the ventilation standards adopted by the Society in August, 1932.

Central Fan Heating and Air Conditioning Systems are treated in Chapter 24. This chapter contains a considerable

amount of information and data which have not heretofore been published, whereas many changes were made in the material on the design of air ducts (Chapter 33) including the introduction of new and more complete examples showing the latest methods of arriving at accurate sizes.

In Chapter 36, which deals with Natural Ventilation, a completely new treatise of this subject has been given. Extensive changes have also been made in Chapter 38, dealing with Fans and Motive Power, whereas the second part of Chapter 29, dealing with Test Instruments and Methods, is entirely new.

Other chapters in which numerous revisions were made include Chapter 4, Infiltration Heat Losses; Chapter 6, Radiators and Gravity Convectors; Chapters 9 and 10 dealing with Steam Heating Systems; Chapters 16, 17 and 18 dealing with fuels and appliances for the combustion thereof; and Chapter 43 on Smoke and Dust Abatement.

The 45 chapters and 592 pages of text matter in The Guide are supplemented by a valuable Catalog Data Section of Modern Equipment in which detailed descriptions, sizes, capacities, and dimensions of various commodities and appurtenances are given.

The first technical paper was announced by President Rowley and the presentation was made by F. C. Houghten, Director of the Society's Research Laboratory. The paper was entitled Cold Walls and Their Relation to the Feeling of Warmth, by F. C. Houghten and Paul McDermott. (Complete paper published in the January 1933 Journal.)

Comments on this paper were offered by E. C. Evans, Prof. A. P. Kratz, L. A. Harding, Prof. H. B. Dirks, Prof. A. C. Willard, Dr. Leonard Greenberg, and Prof. W. M. Sawdon.

The subject of summer cooling was announced by President Rowley, who said that two papers had been prepared on the subject as a result of investigations sponsored by the Society in cooperation with the *National Warm Air Heating Association,* the *National Association of Ice Industries,* and others, at the University of Illinois.

The first paper entitled Study of Summer Cooling in the Research Residence at the University of Illinois by A. P. Kratz and S. Konzo, was presented by Mr. Konzo of the University of Illinois. (Complete paper published in the February 1933 Journal.)

Comments on the subject were made by L. A. Harding, M. G. Harbula, A. J. Nesbitt, Homer Linn, and James Govan. The questions were answered by Prof. A. P. Kratz.

Summer Cooling Operating Results in a Detroit Residence by J. H. Walker and G. B. Helmrich, was the title of the paper given by J. H. Walker. (Complete paper published in the February 1933 Journal.)

Those who discussed the paper were E. K. Campbell, J. E. Maynard, E. D. Milener, W. H. Carrier, and A. P. Kratz. Questions brought out in the discussion were answered by one of the authors, Mr. Helmrich.

W. L. McGrath, President of the *National Warm Air Heating Association,* was introduced and presented greetings from the Association and expressed his satisfaction in the results of the cooperative work being done at the University of Illinois.

A. Bachman, Secretary of the *Cincinnati Association of Heating and Piping Contractors,* presented greetings from the National Association and told of the necessity for cooperative effort in making progress in our field.

Appreciation of the work of the Society was expressed by Patrick Sullivan, representative of the *United Association of Journeymen, Plumbers, and Steamfitters.*

FOURTH SESSION—

Tuesday, January 24, 1933, 2 P. M.

President Rowley opened the meeting and introduced E. K. Campbell of Kansas City, who presented the report on the Committee of Chapter Relations.

Report of Chapter Relations Committee

To the Members of
American Society of Heating and Ventilating Engineers.

The activity of the Chapter Relations Committee during the past year has been divided between two lines of effort. First, to help those Chapters desiring it, by providing speakers and offering other program suggestions and second by promoting joint meetings between the Chapters.

In providing speakers we have tried to bear in mind that these are hard times. The Chapters have most of them reduced their dues and haven't much money in the treasury for the payment of speakers' expenses. So we have tried to get speakers who while adhering strictly to the standards of the Society regarding advertising, yet in one way or another would feel repaid so they could pay their own expenses.

These speakers have according to the reports, given uniformly desirable and happy talks which have pleased the Chapters who have heard them very much.

During the year 28 meetings have been arranged by the Chapter Relations Committee either by providing a speaker or by suggesting a speaker who has been arranged for directly by the Chapters or by suggestion of motion pictures or other features.

It is unfortunate that the Committee has been of very little assistance to the Pacific Coast Chapters and it is the more to be regretted because contact between those Chapters and the parent body is more difficult because of the distance involved.

It is evident that the larger Chapters have little need for the services of the Committee because they have such a wealth of material available for their meetings at all times, and right at their doors. They, of course, have more intimate knowledge of those possibilities than the committee could have.

We ask the Chapters in the larger cities to help the committee by passing on to us information about speakers who might be available for other Chapters and whose talks have been pretty good. We ask them to pass on any ideas they may have to the Committee other Chapters might be interested in.

We do not regard the Chapter Relations Committee as a source of ideas but rather as a clearing house for ideas and we hope that as the Chapters find things that are of particular interest and value, that they will pass them on to the committee.

It is to be hoped that as the results of the Chapter Relations Committee become better known and understood, that the committee may be of more service to all of the Chapters and particularly those who have the need for it.

The committee has had an idea that it would be well to promote cordial relations between the Chapters as well as to help in the Chapter meetings, and with that in view it persuaded the Kansas City Chapter to extend an invitation to the St. Louis Chapter for a joint meeting to be held in Kansas City. To this meeting came 10 of the St. Louis Chapter bringing with them Professor Willard as the speaker of the meeting. This resulted in a considerable extension of acquaintanceship between the membership of the two Chapters and the meeting was so successful that before it was over, a spontaneous demand arose for another joint meeting which was actually held in Urbana at the Research Laboratory of the University of Illinois, Oct. 15th. To this meeting were invited the membership at large and particularly the members of Illinois and Wisconsin Chapters in addi-

tion to those of St. Louis and Kansas City. All four Chapters had representatives there, with a total attendance of about 35.

It is understood that the Minnesota and Wisconsin Chapters have a joint meeting schedule to be held some time in the spring at some half way point, probably La Crosse.

It seemed to the Chapter Relations Committee that joint meetings of this sort even though not attended by a large percentage of the membership, would promote acquaintanceship between the Chapters in a very happy way and the few joint meetings that have been held have proved out just that way and we strongly urge that more Chapters try out the joint meeting idea and we offer the services of the Committee toward arranging such meetings, wherever we can be of service.

E. K. CAMPBELL, *Chairman,*
Chapter Relations Committee.

W. T. Jones took the chair and explained the idea of the Committee on Constitution and By-Laws regarding the make-up of the Nominating Committee and stated that when the plan was presented at the Council not all were in agreement. It was, therefore, decided to present this matter with the question of dues rate to the Advisory Council.

W. H. Driscoll, expressing the views of the Advisory Council, suggested the matter of admission fees and dues be discussed first. He then presented the following motion, that *Section* 1, Article B-IV, read as follows:

That the admission fee of members, associate members, junior members and student members shall be as determined by the Council until 1934, and thereafter the admission fee of members, and associate members, shall be $15.00, of junior members $5.00, and of student members, $2.00. Admission fee must accompany application.

Further—that *Section 2* read as follows:

The annual dues of members, associate members, junior members and student members shall be as determined by the Council until 1934, and thereafter the annual dues of members, and associate members shall be $25.00, of junior members $12.00, and of student members, $3.00.

The motion was seconded by C. V. Haynes and on vote was adopted.

On motion of W. H. Driscoll, seconded by C. V. Haynes, it was voted that *Sections* 3, 4, 5, 6, 7, 8, 9 and 10 of Article B-XI of the By-Laws be adopted as written. This motion was passed.

W. H. Driscoll then presented the ideas of the Advisory Council regarding the Nominating Committee, which coincided with the views of the Committee on the Revision of Constitution and By-Laws, with the exception of the addition of the following sentence:

No proxies shall be permitted.

This matter was discussed in considerable detail by Messrs. Lyle, Evans, Pickett, and a number of others, with the result that the proposed *Section* 10 was amended to read as follows:

The Nominating Committee shall consist of one member eligible to vote designated by each chapter or his alternate also appointed by the chapter. The secretary of each chapter shall certify to the secretary of the Society on or before January 1, the names of the member and alternate selected.

The Committee shall meet at the Annual Meeting of the Society at the call of the Secretary of the Society and shall effect its own organization and elect its own Chairman. At the Semi-Annual Meeting of the Society, if possible, the Nominating Committee shall select the nominees for the ensuing year for the offices of President, First Vice-President, Second Vice-President, Treasurer, and four (4) members of the Council. In any event the names of the nominees shall be certified to the Secretary of the Society before September 20, with the written consent of each nominee to fill the office for which he has been selected and their names with the offices to which they have been nominated shall be published in the October issue of the Journal.

The motion was seconded by W. R. Eichberg and passed on vote of the members present.

A motion was then offered to have the Constitution, By-Laws and Rules as amended, submitted to the entire membership for letter ballot. This motion was carried.

A paper, entitled, Corrosion as Related to Air Conditioning Equipment, was given by the author, R. M. Palmer, New York, who explained that the factors of temperature and clarity of the water are not sufficiently comprehensive to permit adoption of any given water for air conditioning use. (Complete paper published in November, 1932, Journal.)

The chemical analysis of a water should be known before adopting same for use. Further, periodical analyses of water used should be made to determine its corrosive properties. Oxygen, carbon dioxide and products of combustion of various fuels constitute principal contaminents of water which give rise to corrosion troubles. Water used for washing air may be non-corrosive at start of use, but become rapidly corrosive due to absorption of acidic material.

Properly controlled chemical conditioning of water decelerates corrosion and maintains satisfactory heat transfer rates.

In the absence of the author, the paper prepared by Samuel R. Lewis, Consulting Engineer, Chicago, entitled, Air Supply, Distribution and Exhaust Systems, was presented in abstract by the Secretary. (Complete paper published in October, 1932, Journal.)

A. J. Offner, Consulting Engineer, New York, presented his paper, entitled, Cow Barn Ventilation, which resulted from studies made by the author in order to provide proper housing for blooded stock. (Complete paper published in January, 1933, Journal.) A number of written discussions were contributed and P. D. Close, Technical Secretary of the Society, read the comments of W. B. Clarkson, Owatonna, Minn., J. L. Strahan, White Plains, N. Y., Prof. A. M. Goodman, Ithaca, N. Y., and Dr. K. W. Stouder, Ames, Iowa. Other discussions were given by Homer Linn, Chicago, and Prof. A. I. Brown, Columbus, Ohio.

A brief abstract of the paper, Air Infiltration Through Steel Framed Windows, by D. O. Rusk, V. H. Cherry and L. Boelter, was presented by P. D. Close in the absence of the authors. (Complete paper published in October, 1932, Journal.)

FIFTH SESSION—

Wednesday, January 25, 1933, 9:30 A. M.

President Rowley announced that the closing session of the 39th Annual Meeting was open for business and stated that two excellent papers from the Society's Research Laboratory in Pittsburgh were to be presented. J. L. Blackshaw gave a summary of the results reported in the paper, Flow of Condensate and Air in Steam Heating Returns, by F. C. Houghten and Carl Gut-

berlet. (Complete paper published in the December, 1932, Journal.)

A second paper entitled, Condensate and Air Return in Steam Heating Systems, by F. C. Houghten and J. L. Blackshaw, was also presented by Mr. Blackshaw. (Complete paper published in the March, 1933, Journal.) The discussion was participated in by Messrs. C. V. Haynes, Prof. G. L. Larson, W. T. Jones and a number of questions were answered by F. C. Houghten, Director of the Society's Research Laboratory.

The installation of officers was conducted by Messrs. Harding, Larson and Campbell. The new president, W. T. Jones, Boston, was escorted to the platform and introduced. The gavel was turned over to him by the retiring president, Professor Rowley. First Vice-President C. V. Haynes, Philadelphia, and Second Vice-President John Howatt, Chicago, were presented to the members and the Treasurer, D. S. Boyden, Boston, was introduced. The members of the Council to serve for three years were escorted to the platform and presented to the members.

With President Jones presiding, several resolutions were offered.

W. H. Driscoll presented the following motion:

Resolved, that the Secretary of the Society be instructed to communicate with our fellow member, Mr. Andrew C. Edgar, of Philadelphia, and express to him the hope of the members assembled that his recovery to health will be speedy and to assure him that his record with the Society of having attended each of its 39 Annual Meetings remains intact and, further, inform him that the spirit of his presence was felt at the Annual Banquet even though he could not occupy the seat reserved for him.

The motion was seconded by J. J. Aeberly and unanimously adopted.

The Report of the Resolutions Committeee was presented by the chairman, M. F. Blankin, of Philadelphia, and the following resolutions were unanimously adopted by rising vote:

Be it resolved, that the Cincinnati Chapter A. S. H. V. E. in spite of the handicap of being less than six months old have rendered most distinguished service in conducting this Thirty-ninth Annual Meeting and that the A. S. H. V. E. here assembled do hereby express their most hearty and sincere thanks to the Chapter and the hard working committees.

Be it further resolved, that Mr. Sam Fowlkes, the Convention Manager of the Gibson Hotel, has been most gracious and efficient in giving us unparalleled service, and that we herewith tender our keen appreciation to him, the staff and the management.

Be it further resolved, that Cincinnati's Convention Committee have rendered most valuable cooperation and service in connection with our Thirty-ninth Annual Meeting and that we hereby extend to them our hearty commendation.

Be it further resolved, that the Cincinnati newspapers have given us a far greater amount of publicity than ever before received in our thirty-nine years of existence and that we do wish to express our most sincere gratitude.

Be it further resolved, that the Society's thanks be extended to the Trade Press for their attendance at this Convention in greater numbers than ever.

Be it further resolved, that all the railroads coming into Cincinnati have given us most courteous cooperation, especially the Baltimore and Ohio Railroad in connection with providing transportation and unusual accommodations in sending home our beloved member, Mr. A. C. Edgar, who was taken sick while attending the Meeting.

Be it further resolved, that a copy of these resolutions be spread upon the minutes of this meeting and the Secretary be instructed to send letters of appreciation to each of the party or parties referred to advising them of the action of the Convention.

At the call for new business W. H. Driscoll proposed the following resolution which was seconded by W. W. Timmis:

Resolved, that a committee be appointed by the president to consider the question of the elimination of the term *"square foot,"* now used in connection with the ratings of heating boilers and radiators, and the substitution therefor, of a new term or expression that will properly and adequately indicate a unit of heat transmission, not only as applied to the ratings of boilers and radiators, but sufficiently comprehensive to be applicable to related arts and industries: such as warm air heating, unit heating, refrigeration, fuels, etc., *and be it further resolved,* that this committee be instructed to confer with the *Institute of Boiler and Radiator Manufacturers,* the *Heating and Piping Contractors National Association,* the *American Society of Refrigerating Engineers,* and other interested trade associations and engineering societies in order to obtain their advice, assistance and cooperation; and further that the committee be instructed to make a report and recommendation to the Society at as early a date as possible.

The resolution was adopted.

As no more new business was offered, announcement was made of a Council meeting immediately following the session and the 39th Annual Meeting of the Society adjourned.

Good Old Cincinnati!

AN unusually large number of members and guests came to Cincinnati for the 39th Annual Meeting of the Society and found that Chairman W. C. Green and his Committee on Arrangements had provided many pleasant diversions for both men and ladies. The Reception and Registration Committees were on the job early Monday morning to receive the incoming visitors and, when the total registration was counted, 255 were on the record.

Chairman A. W. Rooks and his Reception Committee made everyone welcome and E. B. Royer and his Registration Committee provided programs, badges and information about the schedule of activities.

The ladies had their first get-together at a Luncheon on Monday noon in the Bird of Paradise Room of the Hotel Gibson. Directly after the meal, they enjoyed a Bridge and Tea in the Golden Palm Room.

The Past Presidents held their customary dinner at 6:30 on Monday evening and those present were F. Paul Anderson, W. H. Carrier, W. H. Driscoll, L. A. Harding, J. I. Lyle and Prof. A. C. Willard.

At 8:30 on Monday evening an Over the Rhine Party was held on the Roof Garden of the Hotel Gibson, which had been transformed into a bit of Old Cincinnati. An excellent buffet supper was served on the Sidewalk Cafe and in the Rathskeller. A musical entertainment and dance were enjoyed throughout the evening by nearly 300 who were present to enjoy the festivities, which were directed by I. B. Helburn, chairman of the Entertainment Committee. There were no dissenters to the opinion

that the evening was a record-breaking success from every standpoint and a return to the good old days on Vine Street was favored.

Early on Tuesday morning the ladies assembled for a sightseeing trip through Cincinnati and they enjoyed an inspection of the Taft Museum and the Rookwood Pottery. Returning to Hotel Gibson, the ladies had luncheon in the Florentine Room and then enjoyed a theatre party during the afternoon.

The Annual Banquet started promptly at 7:30 under the guidance of H. E. Sproull, chairman of the Banquet Committee. During the dinner the orchestra played popular numbers and G. B. Houliston led community singing of such popular favorites as There's a Good Time Coming, How Do You Do, You Can't Fool an Old Horse Fly, and The Old Gray Mare—She Ain't What She Used to Be. While the music was familiar, the majority of the verses were new, so that the audience found it helpful to sing them from stereopticon slides, which were thrown on the screen.

There were several surprise numbers introduced and there was considerable mystery about the authorship of the verses, which were exceedingly appropriate and entertaining.

The toastmaster was L. A. Harding, Buffalo, Past President of the Society, and his witty introductions and comments were haled with delight by the audience. An interesting and instructive talk, entitled Tomorrow's Home, was given by Bennett Chapple, vice-president of the American Rolling Mill Co.

The Past President's Medal was presented to Professor Rowley by W. H. Driscoll, who in a brief and fitting speech told the special significance of the emblem, which is worn by all past presidents of the Society. In response, Professor Rowley thanked the Society for the honors conferred upon him and expressed his pleasure for the opportunity of serving the A. S. H. V. E.

The toastmaster introduced President-elect W. T. Jones, Boston, who expressed his desire to successfully carry on the work of the Society and maintain its influence and prestige.

At the conclusion of the dinner, dancing was enjoyed until one o'clock.

Arrangements for the ladies entertainment were made by R. B. Breneman and his committee and Mrs. H. N. Kitchell and a group of the Cincinnati ladies acted as hostesses, with the result that an exceptionally enjoyable three days was spent.

Transportation arrangements were in the hands of C. E. Hust, who arranged the various trips for visiting members and ladies and also found time to double in the activities of several of the committees.

The extensive publicity campaign was arranged for by J. J. Braun and valuable assistance was rendered by Fred Toy.

In the early hours of the meeting, lines of worry furrowed the forehead of C. J. Kiefer, chairman of the Finance Committee, but when the budget balanced, his smile was continuous and contagious.

W. C. Green, the General Chairman, and H. N. Kitchell, the Vice-Chairman, were always on hand to see that every detail which would contribute to the success of the meeting was carried out and reflect Cincinnati's well known reputation for hospitality.

Unstinted praise was given the Cincinnati Chapter members for the very successful meeting that they had engineered and the 39th Annual Meeting of the Society was voted a tremendous success by all who attended.

Those who served on the Committee on Arrangements are as follows:

W. C. Green, *General Chairman*
H. N. Kitchell, *Vice-Chairman*

Publicity
J. J. Braun, *Chairman*
K. A. Wright F. D. Mensing

Reception
A. W. Rooks, *Chairman*
R. W. Sigmund

Ladies
R. B. Breneman, *Chairman*
I. B. Helburn H. N. Kitchell

Registration
E. B. Royer, *Chairman*
O. W. Motz R. W. Sigmund

Entertainment
I. B. Helburn, *Chairman*
R. B. Breneman H. N. Kitchell

Banquet
H. E. Sproull, *Chairman*
O. W. Motz H. A. Pillen
A. Winther

Finance
C. J. Kiefer, *Chairman*
W. J. Doyle R. E. Peck

Transportation
C. E. Hust, *Chairman*

President Jones Plans Chapter Visits

During the month of April, President W. T. Jones will make a series of Chapter visits commencing April 3 in Buffalo as guest speaker at the Western New York Chapter meeting. On April 4, he will go to Toronto for a visit with the Ontario members, and on Thursday, April 6, the Michigan Chapter members will entertain him at Detroit. Friday, April 7, will find him at Grand Rapids with the Western Michigan members.

On Monday evening, April 10, the Illinois Chapter will hear President Jones talk on The Status Quo of Engineering. The Pennsylvania Chapters will then entertain Mr. Jones at Pittsburgh, Tuesday, April 11, and Philadelphia, Thursday, April 13.

Engineers' Week at Century of Progress

The week of June 25-30 has been designated as Engineers Week during the Century of Progress Exposition at Chicago. An Engineering Societies Committee has been formed with H. B. Gear, *chairman*, and E. S. Nethercut, *secretary*. The sponsoring bodies are the *Western Society of Engineers*, the *A. S. C. E.*, *A. I. E. E.*, *A. I. M. M. E.*, and the *A. S. M. E.* An elaborate program has been planned and in addition to the meetings of the individual societies, Wednesday, June 28, has been designated as Engineers Day with all of the societies participating in a monster program.

The Sixth Midwest Engineering and Power Exposition is scheduled for the Coliseum during Engineering Week and manufacturers plan to show the latest developments in steam and electrical generating equipment for power and process purposes.

In addition to the engineering activities, a number of organizations have planned meetings for the month of June, among which are the *National Warm Air Heating Association* at the Hotel Stevens, June 6-8, the *American Oil Burner Association* at the Hotel Stevens, June 12-16, and the *National District Heating Association*, June 26-28.

Case School Plans Manufacturers Conference

A Conference on Re-Engineering for Economical Manufacture is to be held at Case School of Applied Science, Cleveland, March 22-24, with Prof. E. S. Ault as general chairman. This conference, jointly sponsored by Case School of Applied Science, the *Cleveland Engineering Society* and several national engineering organizations, will present a program that will attract officials of manufacturing industries and bring speakers of national prominence.

Twelve subjects appear on the tentative program just issued by the committee in charge as follows:

Planning for Profits; Production Development—Whither Bound?; The Economic Aspect of Entering Competition in Another Industry; Redesign of the Product to Increase Appeal to the Purchaser; Economical Selection of Equipment; Developments in Improved Manufacturing Processes; Metal Forming to Eliminate Machining; The Place for Stampings in the Product; Influence of Welding on Design and Production; Changes in Plant Layout to Accommodate Varying Production; Selection of Economic Manufacturing Quantities for the Small Industry; General Factors Entering a Production Program.

Local Chapter Reports

Cincinnati

February 14, 1923. St. Valentine's Anniversary was appropriately observed by the Cincinnati members when with due appreciation for the date and the occasion, Chairman E. B. Royer, of Meetings Program Committee, continued his series of Open Meetings with a warm program and a hearty reception of it. Undoubtedly the Red Heart of Valentine's Day was in evidence.

Through the courtesy of the Union Gas & Electric Co., the meeting convened in their auditorium. Pres. K. A. Wright called the meeting to order and turned the proceedings over to Mr. Royer, who gave an interesting prospectus of future meetings on his program, inviting all present to attend and to invite their friends. Mr. Royer then introduced to an audience of 90 engineers, the speaker of the evening, R. M. Conner, Director of A. G. A. Testing Laboratory.

Mr. Conner's topic was Gas for Heating. Prefacing his address, he presented a concise history of the A. G. A. Laboratory. The talk touched on tests of gas appliances conducted by the A. G. A. Laboratory; the interesting extent of the gas industry which includes 5¼ billion dollar investment, 220,000 miles of mains, 14½ million customers, and daily domestic service to 60 million people; space heating equipment; gas heating appliances; application of performance and efficiency ratings; design of hoods, vents, etc., and an informative discussion of the cooperation of the Gas Association's Committee on Standards with the American Standards Committee.

Mr. Conner then presented a contemporary survey of several fuels, including coal, coke, wood, petroleum and gas, consumed nationally for energy purposes; discussing the future of gas heating and its particular use for house heating and air conditioning. Lantern slides of the Laboratory and Test Houses were shown and general discussion of the address was invited. The discussion was led by Mr. Royer, and President Wright, until Mr. Conner had satisfactorily answered all questions.

Mr. Royer expressed the chapter's appreciation of Mr. Conner's address, President Wright adjourned the meeting, and the members mingled for refreshment and personal contacts, until "Lights Out" was sounded.

January 12, 1933. "To the Cincinnati Ladies." W. C. Green ("Billy" to the oldsters; "Chief" to the cubs), General Chairman of the 39th Annual Meeting, knew that no party is a "party" and no convention a "success" unless supported and adorned by the "Power behind the Throne." So he bid all Cincinnati Chapter Members be present to Meet, Mix, Eat, Dance and Admire.

The Dinner-Dance Meeting got under way smoothly when Chief Billy, taking advantage of the recently enacted Mercy Laws, dropped a couple of cherries, 1 cube of ice, "and other considerations" in each glass, then raised the glasses and lowered the cherries to the Glory of the Ladies and the Success of the Convention. Notably present were just about every one of the local chapter members, with wives (one each) and notably absent was Ladies Committee Member (Power behind the Throne) Mrs. R. B. Breneman, whom we missed, and whom we believe might have been there had she known just how the ladies were going to receive our Official Ladies Man. We hope she and Mrs. Robt. E. Peck will be off the sick list for all future meetings. Courageously present amongst all the members with wives (still one each) was one member, Carl E. Hust, with "date," and so graciously present was the "date" that Miss Helen Adams immediately became a member of the official family.

Having Met and Mixed, we carried on with the "Eat, Dance and Admire" part of the program, enjoying at a "flower bedecked board" on the Florentine Mezzanine, Hotel Gibson, a dinnner selected by Chief Billy Green, and arranged with intervals during which we enjoyed our private dance floor and Seymore Simons' Orchestra.

Having become well enough acquainted to interrupt any "member-having-the-floor" we went back to the "Meeting" part of our program, when Mr. R. B. Breneman with the assistance of Power-behind-the-Kitchell-throne, organized the ladies with Mrs. H. N. Kitchell as active chairman of the group, and may we be pardoned for emphasizing the "active." Knowing that the National Body had selected wisely, we had "The Kitchells" on several committees and took advantage locally of the Research Ability—we knew they had researched through many meetings.

And So To Bed, after a meeting which was a great success in itself, and which was THE meeting that made the 39th Annual Meeting a Grand and Enjoyable Affair for members of Cincinnati Chapter.

As for You All (you're down South now) you will be advised in a later report that the Convention was a good one and further, that you enjoyed it. History and Precedent demand that we speak for you.

December 13, 1932. The current series of meetings of the Cincinnati Chapter was inaugurated with Dean F. Paul Anderson, Lexington, Ky., as the speaker and an audience of 130 members and guests.

The evening was started with a dinner at the Cincinnati Club where Dean Anderson and his party, including D. V. Terrell, M. J. Crutcher and R. S. McCain of the University of Kentucky, were guests of twenty members and friends.

Following dinner, an open meeting was held in the Auditorium of the Union Gas and Electric Co., where Dean Anderson spoke to an interested audience of 130 engineers on the Future of Engineering and Air Conditioning.

Pres. K. A. Wright welcomed the guests and introduced them to the speaker. Dean Anderson broadened his address to include more than a technical presentation and gave the group of engineers present a keener appreciation of their privileged part in providing comfort for mankind.

President Wright expressed the Chapter's gratitude to the speaker and detained him for additional discussion. This was devoted to an explanation of experiments at the University of Kentucky in which a special room is being developed for alleviation of hay fever and other diseases by correct air movement and treatment.

The meeting like Gaul was divided into three parts—and the final phase was the Victory Meeting but reporters were not permitted so the details about who was victorious, when, where and why must be supplied by the Dean and his henchmen.

Cleveland

January 13, 1933. The meeting was called to order at 8:15 p. m. in the Chapter Rooms of the *Cleveland Engineering Society* with the best attendance in some time, 55 members and guests being present.

The minutes of the December meeting were read and approved and the secretary, F. A. Kitchen, called attention to the Annual Meeting of the Society at Cincinnati, January 23-25. It was moved and seconded that the one member of the Nominating Committee be reimbursed for one-half the railroad expense to and from the Annual Meeting.

The interest of the meeting was added to by the members and guests rising and giving their names and affiliations.

W. E. Stark of the Membership Committee reported that a new member had been secured and that new Limited Membership blanks were ready for a concentrated drive by all Cleveland Chapter members.

J. C. Miles, chairman of the Program Committee, presented the speaker of the evening, H. B. Meller, of the Department of Health, Pittsburgh, Pa., whose subject was the Modern Aspect of Smoke Protection Abatement. Mr. Meller gave a splendid talk, covering the causes of smoke, soot and dirt as found in various cities throughout the country and the harmful effects of such pollution. Considerable discussion followed the talk and the speaker later reviewed the methods pursued by his department in controlling the use of various devices for the automatic burning of coal in the City of Pittsburgh.

The meeting was adjourned at 10:30 p. m. with a rising vote of thanks to the visiting guests.

Illinois

February 13, 1933. Dinner was served at 6:30 p. m. to 48 members and guests who had gathered at the Hotel Sherman. Pres. J. H. O'Brien called the meeting to order at 7:50 p. m. and the reading of the minutes of the January meeting was dispensed with, due to the great length of the program.

R. E. Hattis, chairman of the Membership Committee, was called upon to report the activities of his committee in their effort to increase the attendance at the Chapter meetings and satisfactory progress should result from the work of this well organized committee.

The application of E. M. Mittendorff for membership in the Illinois Chapter was presented to the members and approved.

J. J. Aeberly, the Chapter representative on the Nominating Committee at the Society's Annual Meeting at Cincinnati, called attention to the importance of this selection and suggested that the Board of Governors prepare special instructions for this representative.

John Howatt handled the month's regular feature, Ten Minutes of Something New. He presented an excellent resumé of the activities at the Cincinnati Meeting and followed by calling the Chapter members' attention to a graph depicting building permits, expressed in dollars, covering the entire country for the years 1923 to 1932. A second graph depicted the same statistics for Chicago alone. Apparently, Chicago's building during these years has been far below the average.

L. R. Flook, mechanical engineer and superintendent of buildings and grounds at the University of Chicago, gave a most interesting illustrated talk on the carillon of 72 bells installed in the Chapel at the University. He described in detail the casting of these bells, the tuning of each one, and the problems encountered in their erection. An excellent motion picture illustrated Mr. Flook's description of these wonderful chimes.

S. R. Lewis then introduced Prof. G. L. Larson, Dept. of Engineering, University of Wisconsin, and Chairman of the Committee on Research, A. S. H. & V. E. Professor Larson addressed the Chapter on Society Research Accomplishments in 1932. He gave a brief description of the many problems encountered by the Research Committee during the past year of economic distress. Professor Larson was particularly pleased with the cooperative arrangements made with the various universities to carry on research work at their laboratories. He cited the many benefits obtained by the Society at a relatively small cost. The Finance Committee was given great praise for their excellent work, having raised about $34,000. Professor Larson praised the technical papers presented at Milwaukee and Cincinnati and ended his talk with a few words on plans for the coming year.

Considerable discussion followed Professor Larson's talk, entered into by Messrs. Hart, Blanding, Lewis, Hattis, DeLand, Aeberly and Howatt.

The meeting adjourned at 9:40 p. m.

January 9, 1933. A joint session with the Chicago Section of the *American Society of Refrigerating Engineers* brought 189 members and guests to the Hotel Sherman and, following dinner, Pres. J. H. O'Brien called the meeting to order.

The new feature of the Chapter programs, Ten Minutes of Something New, was in the competent hands of Samuel R. Lewis who discussed Air Cleaning Devices. Mr. Lewis gave a brief resumé of the development of the air filter and closed his talk with a recommendation regarding the rating of air cleaning devices.

President O'Brien extended a few words of welcome to the officers and members of the *A. S. R. E.* and stressed the importance of joint meetings to obtain a better understanding of common problems in the air conditioning field. Oscar Anderson, chairman of the Chicago Section, *A. S. R. E.*, and B. E. Seamon, Secretary, replied with remarks well suited to the spirit of the occasion.

Homer R. Linn was called upon to introduce the speaker of the evening, H. J. Macintire, Professor of Refrigeration, University of Illinois, whose subject was Refrigeration and Its Application in Air Conditioning. Professor Macintire spoke of the principles of refrigeration and the development of machines and various types of refrigerants and gave a comprehensive discussion of the experiments on comfort cooling conducted at the Research Residence at Urbana. He urged the engineer to use great care when installing comfort cooling, keeping in mind the many problems involved and stressed the importance of humidity and air motion as well as dry-bulb temperatures.

Professor Macintire's excellent talk was followed by considerable discussion by Messrs. Anderson, Aeberly, Seamon, Hattis and others.

Michigan

February 13, 1933. About 60 members and guests attended the Annual Winter Frolic held at the Prince Edward Hotel in Windsor, Canada.

After a buffet supper, Pres. L. L. McConachie asked for a discussion of future meetings of the Chapter.

J. F. McIntire spoke of the Society's Semi-Annual Meeting to be held in Detroit, in June, 1933, after which the remainder of the evening was given over to fun and entertainment.

January 10, 1933. At a dinner meeting the Detroit Edison Co. was host to the Michigan Chapter and, after dinner served in the dining room, 95 members and guests assembled in the Auditorium.

Pres. L. L. McConachie called for nominations for representative and alternate on the Society Nominating Committee with the result that J. H. Walker and H. E. Paetz were elected representative and alternate respectively.

A vote of the membership showed that the majority were in favor of a social meeting to be held in Canada in February.

S. S. Sanford gave an illustrated lecture on Summer Cooling and discussed results and costs of several installations made during the past summer.

The remainder of the evening was given over to games before the meeting adjourned at 10:00 p. m.

Western Michigan

January 9, 1933. In the absence of Pres. D. L. Taze, K. L. Ziesse, Vice-President, presided at the January dinner and meeting of the Western Michigan Chapter held in the English Room of the Rowe Hotel with 53 members and guests in attendance.

The million dollar Civic Auditorium, just completed in Grand Rapids, prompted a study and inspection of its mechanical equipment. Burritt A. Parks, consulting engineer of the building, presented a paper with the aid of stereopticon slides, describing in detail the heating, ventilating and lighting systems. After a general discussion, the meeting adjourned to the Auditorium, where Mr. Parks conducted the group through the building, making suitable explanations. Of particular interest were the

air conditioning systems for the Auditorium, Assembly Hall and Exhibition Hall. Each having its separate units, summer comfort is attained by cooling, dehumidifying, filtering and circulating the air in a downward diffusion throughout the spaces. Fifty degree well water circulated through special blast coils acts as a cooling agent. Seven supply fans, handling a total of 202,000 cfm, are used in handling the air for these three rooms. It is pointed out that the cost of the mechanical work, including the plumbing, heating, ventilating and electric wiring, was slightly less than 25 per cent of the entire building cost.

Minnesota

February 13, 1933. The Minnesota Chapter of the A. S. H. V. E. held their February meeting on the 13th, starting at 3:30 p. m. in the afternoon as the guests of Prof. F. B. Rowley and A. B. Algren at the Laboratories of the Experimental Engineering Building, University of Minnesota. Sixty members and guests were present to witness the series of experiments which had been specially set up on air filters, unit heaters, oil fired boilers, gas fired warm air furnaces, distribution of air through ducts of a warm air heating plant and other tests equally interesting.

At the conclusion of these tests, the meeting was adjourned to the Men's Union Building where dinner was served at 6:30. Following the dinner, the regular business meeting was opened by Pres. W. F. Uhl. The minutes of the previous meeting were read by the Secretary and approved. Professor Rowley gave an interesting report on the 39th Annual Meeting of the Society at Cincinnati. Mr. Algren announced that the March meeting of the Chapter would be held at the plant of the Minneapolis Honeywell Co. and that details of the trip would be announced later.

There were 58 members present at dinner and with others coming in later, 68 took part in the discussion of the tests conducted during the afternoon. At the conclusion of the discussion, the meeting was adjourned.

January 16, 1933. The first meeting in 1933 of the Minnesota Chapter was held at the Men's Union Building of the University of Minnesota with 48 in attendance.

After dinner had been served, Pres. W. F. Uhl opened the meeting and the secretary, C. E. Lewis, read the minutes of the previous meeting. Albert Buenger was called upon by President Uhl to outline arrangements for the February meeting, at which time it is planned to have the Chapter gather at the Laboratories of the Experimental Engineering Building at 3:30 p. m. to witness a series of tests to be run on various devices such as air filters, warm air heating distribution ducts, etc. At the conclusion of these tests at 5:30 the meeting will then adjourn to the Men's Union Building where dinner will be served and, following dinner, a general discussion will be held covering the tests witnessed during the afternoon. The Chapter voted its approval of the plans for this meeting and instructed Messrs. Algren and Buenger to proceed with the arrangements.

Mr. Buenger then presented L. C. Gross, who gave a paper illustrated with a series of charts which showed the method of procedure in figuring the heat losses and the heat gain for a restaurant to provide for heating and cooling for human comfort. Mr. Gross gave a very thorough analysis of the problem and his talk was well received by the membership. A discussion followed of the various points presented.

Prof. F. B. Rowley was then called upon by Mr. Buenger to explain the use of the Bulkeley Psychrometric Chart. Slides showing this chart and several others were projected upon a screen and Professor Rowley very ably went into the details of the use of the chart in the handling of an air conditioning problem.

The meeting was adjourned at 9:30 following Professor Rowley's discussion.

New York

February 20, 1933. Pres. L. T. M. Ralston's resignation was read by the secretary who stated that the Board of Governors had carefully considered Mr. Ralston's resignation and under the circumstances it recommended to the Chapter that the resignation be accepted and that the office of president be left vacant for the short time elapsing until the next annual election of officers in April. A. J. Offner made the motion of acceptance which was seconded by H. W. Fiedler and the Chapter voted its acceptance.

Vice-President Harold Alt read a letter from Mrs. H. G. Issertell regarding her husband who will be confined for some time in his home as a result of an automobile accident on January 28. Officers of the Chapter will call upon Mr. Issertell and it was suggested that members do likewise.

Mr. Offner made a few remarks about his visit to the Annual Meeting of the Society at Cincinnati and W. H. Driscoll recited how Mr. Offner's paper on Cow Barn Ventilation received the most favorable comment at that meeting. R. H. Carpenter then told of Mr. Driscoll's role as song leader accompanied by an old fashioned German band.

W. W. Timmis mentioned that E. K. Campbell of the National Membership Committee had requested the Chapter's plans on membership.

The meeting was then devoted to a Symposium on Automatic Controls at which the speakers were W. W. Timmis, G. D. Kingsland, and E. G. McCutcheon.

It soon became evident that the matter of automatic controls has become highly specialized. The speakers spoke at length and in considerable detail illustrating their remarks with slides of diagrams and charts. Valve control exhibits showed the history and development of automatic controls, 21 types clearly demonstrated the perfection of action and appearance.

The audience was unusually attentive, some discussion followed the speakers' remarks, and the meeting adjourned after 11 p. m.

Western New York

February 18, 1933. On this date was held the Annual Dinner Dance and Installation of Officers. The scene was the main dining room of Gandy's and judging by the attendance, this annual affair is still one of the high lights of the season.

Pres. M. C. Beman, in turning over the reins to incoming Pres. D. J. Mahoney, fittingly thanked everyone for the loyal support given to him throughout the past year. The new officers were then presented as given in the report of the January 9 meeting.

The new president, Mr. Mahoney, briefly but fittingly asked for the same loyal support and promised to carry on in spite of adverse conditions.

The program committee promises an interesting speaker for the next regular meeting to be held at Gandy's on March 13.

Ontario

February 6, 1933. Twenty-four members and guests were present at the Prince George Hotel, where the February meeting of the Ontario Chapter was held at 6:00 p. m.

Following an enjoyable dinner, Pres. J. S. Wood called upon the secretary, H. R. Roth, to read the minutes of all previous meetings held during the year and these were accepted as read.

President Wood then introduced the principal speaker of the evening, E. Holt Gurney, member of the Council. Mr. Gurney told of the recent Annual Meeting of the Society in Cincinnati and also discussed present business conditions in the heating and ventilating industry.

A vote of thanks to Mr. Gurney for his interesting address was offered by H. H. Angus and enthusiastically approved by the members.

The matter of reducing Ontario Chapter dues in 1933 was discussed and a motion was made that the Board of Governors investigate the financial condition of the treasury and consider appropriate action.

Pittsburgh

January 16, 1933. The regular January meeting of the Pittsburgh Chapter was held in the auditorium of the U. S. Bureau of Mines and 38 members and guests were present when Pres. G. S. McEllroy called the meeting to order.

The minutes of the annual meeting held in December and those of a special meeting were read and approved. The report of H. B. Orr, treasurer, covering the financial condition of the Chapter was accepted and ordered filed. President McEllroy, reporting for the Program and Publicity Committee, announced that the February meeting of the Chapter had been arranged to be held in the Bureau of Mines with T. Napier Adlam as the speaker.

The question of Chapter representation on the National Council of the Society was discussed, in view of the proposed revision of the Constitution. It was decided that past chapter correspondence and activity on this matter be reviewed by E. C. Evans, who was appointed to present to the national organization at its 39th Annual Meeting in Cincinnati the resolution prepared by the Pittsburgh Chapter in May, 1931.

After a discussion of dues and dues reduction, it was moved by Mr. Evans, seconded by F. C. McIntosh, and carried that for a period of three years the Officers and Board of Governors of the Chapter be given power to fix Chapter dues so that they would be in keeping with current economic conditions. Accordingly, dues for 1933 for Members and Associate Members were put at $3.00, Junior Members $1.50 and those for Student Members were eliminated.

The secretary read a report from the A. S. H. V. E. Headquarters concerning the 39th Annual Meeting in Cincinnati, January 23-25. It was announced that R. B. Stanger had been appointed representative of the Chapter on the 1933 Nominating Committee with Mr. McIntosh as alternate.

President McEllroy appealed to the members to pay delinquent dues and to take care of their 1933 dues promptly.

The Chapter's guest and speaker, T. A. Novotney, Johnstown, Pa., was presented by President McEllroy. Mr. Novotney spoke on Concealed Radiators and traced the history of heating. He pointed out how valuable the A. S. H. V. E. Research Laboratory has been in moulding correct heating and ventilating practice. In concluding his talk, Mr. Novotney visualized the day when the lighting in homes and offices would cast no shadows, when conditioned air would eliminate dirt and drafts and give one the feeling of comfort regardless of outside weather, when fuel would be used with perfect economy, and when noise and other aesthetic values in construction had been so cared for that one could live and work efficiently with no distractions.

After a full and interesting discussion of Mr. Novotney's talk, he was given a rising vote of thanks as was also the U. S. Bureau of Mines in appreciation of their kindness in allowing the Pittsburgh Chapter to use its auditorium for the meeting.

St. Louis

February 7, 1933. Pres. C. A. Pickett called the St. Louis Chapter meeting to order in the David Ranken Trade School, following dinner.

After the minutes of the January meeting had been read and approved and reports of various committees were received, Paul Sodemann read the application received from H. W. McLarney.

Secy. C. R. Davis read an acknowledgement from Mrs. E. H. Quentin and family of the floral offering sent by the Chapter in memory of the late E. H. Quentin, charter member of the Chapter and an active member until he resigned upon his retirement.

A report on the Society's Annual Meeting in Cincinnati was given by L. W. Moon, newly elected member of the National Council.

President Pickett introduced the 18 guests who attended the dinner meeting.

The meeting convened in a lecture room of the Trade School and Mr. Moon, chairman of the Program Committee, presented E. A. Jones, Milwaukee, Wis., who gave a paper on Domestic Air Conditioning. Mr. Jones discussed the primary requirements for air conditioning in connection with domestic systems and augmented his talk with stereopticon slides. The paper was greatly enjoyed by the 90 members and guests who were present.

Wisconsin

January 26, 1933. The Relation of Building Construction to Air Conditioning was the subject of the January meeting of the Wisconsin Chapter with Prof. F. B. Rowley of the University of Minnesota and retiring president of the A. S. H. V. E. as the speaker. The meeting was held in the Hotel Pfister and was preceded by dinner.

Pres. V. A. Berghoefer opened the meeting and introduced several guests, Professor Schoen of Marquette University, and Messrs. Osthoff and Wagley.

An announcement was made by the secretary, C. H. Randolph, of a meeting to be held in February in the T. M. E. R. & L. Co's building by the Electrical League of Milwaukee, at which time the subject of air conditioning in its different phases would be discusssed.

President Berghoefer related the sad news that the treasury, which was at a higher level than ever before in its history, unfortunately had been deposited in a bank which went on the moratorium plan. This placed the Chapter in a difficult position and immediate steps were decided upon to take care of the emergency.

The audience insisted that Professor Rowley recite the verses of a song about Prof. G. L. Larson, which was sung at the Cincinnati meeting and proved to be very amusing to those present.

The highlights of the Society's Annual Meeting held in Cincinnati were given by Professor Larson and the report indicated that the Cincinnati Chapter is entitled to a great deal of credit for the method in which they handled the meeting.

With the return of the country to a beer basis imminent, a resolution was offered by Ernest Szekely and seconded by Professor Larson: Resolved that John Jung, Milwaukee, be appointed official keg opener for the Society. The vote of the Wisconsin Chapter was unanimous and your correspondent understands that this matter will be presented to the National Body at some future date.

Ernest Szekely, chairman of the Program Committee, announced that R. F. Norris, of the Burgess Laboratories, would be the speaker for the February meeting and that his subject would be Acoustics and Sound Deadening. At the March meeting Steam Refrigeration will be discussed and in April the subject of Pipe Welding will be covered.

Mr. Szekeley then introduced Professor Rowley, who illustrated his talk with lantern slides and was particularly well equipped to give data on his subject. Considerably more than an hour of discussion took place, indulged in by members and guests, and from all evidences the meeting would have lasted well into the morning if those present had been given their way.

W. A. Rowe Retires

After 25 years' service, W. A. Rowe, Detroit, Mich., has retired as chief engineer of the American Blower Co., having devoted 12 years to design and development work and about an equal time to sales and engineering. Mr. Rowe has been active in the Society as a member of the Committee on Research and on many of its special committees and, while on the Council, served as chairman of the Publication Committee.

H. G. Issertell Injured

While on a visit to the home of his brother in New Jersey, H. G. Issertell, New York, N. Y., suffered painful injuries including a broken leg as a result of being hit by an automobile. He is at home now making a satisfactory recovery after spending several weeks in the General Hospital of Elizabeth, N. J.

Tenth National Oil Burner Show

A decade of progress in the oil burner industry will be celebrated at the Tenth Annual Convention of the *American Oil Burner Association* and the National Oil Burner Show, which is scheduled to be held at the Hotel Stevens, Chicago, Ill., June 12-16, 1933.

Business sessions and other meetings are planned for the mornings, leaving the remainder of the day available for attendance at the exhibits.

Death of A. C. Edgar

In the death of Andrew C. Edgar, which occurred on Monday, February 13, 1933, at his home, Media Road, Newtown Square, Delaware Co., Pa., the Society has suffered the loss of a Charter and Life Member who served on the Council in 1920 and as president of the Philadelphia Chapter.

Mr. Edgar was one of the most loyal of A. S. H. V. E. supporters and, although his desire to shun the limelight was traditional, his willingness to cooperate and serve the Society in any capacity was fully appreciated by his fellow members. He had the unique distinction of attending every one of the Society's Annual Meetings since its organization in 1895, an experience that no other man has had, and it was while attending the 39th Annual Meeting in Cincinnati in January that he was stricken by his last illness.

Born on November 28, 1869, Mr. Edgar had had a long experience in the heating business. At an early age he was an apprentice with the Universal Machine Co. of New York City, where he learned the trade of machinist, and then later entered the employ of Pierce, Butler & Pierce Mfg. Corp. From 1894-1926 he was in charge of research work for the Abram Cox Stove Co., Philadelphia, as engineer, designer and manager of the Boiler Department. For 4 years of this period he conducted research work for the *National Association of Warm Air Furnace Manufacturers* and was for 3 years associated with Prof. R. C. Carpenter, of Cornell University, devoting his energy to research work on burners as applied to gas water heaters. For 12 years he was engaged in the heating contracting business in Philadelphia as president of the Edgar Heating Co.

For a time, Mr. Edgar, temporarily abandoning other activities, was associated with Major Bowles, at Pittsburgh, Pa., in the construction of special dies that were used in the shipbuilding program inaugurated to meet the country's wartime needs.

In 1926 he was elected president of the *Certified Heating Association of Philadelphia,* whose purpose it was to create formulae standardizing boiler, radiator and pipe sizes for heating installations.

In 1930 he was elected Director of the *Philadelphia Heating and Plumbing Contractors Association* and was instrumental in securing agreements between the *Master Heating and Plumbing Contractors* and *the United Association of Plumbers and Steamfitters.* Through his untiring efforts, indefatigable energy and astute diplomacy, he eliminated disputes, strikes and lockouts to the benefit of the general public, employers and employees in the metropolitan area of Philadelphia.

Mr. Edgar was also a member of the Penn Athletic Club and of the Masonic Fraternity—Harmony Lodge No. 52, and a Director of the Hayes Mechanics Home.

Funeral services were held at 2:00 p. m., Thursday, February 16, at 1820 Chestnut St., Philadelphia, and were attended by

Andrew C. Edgar

officers and members of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, the *Heating and Piping Contractors National Association,* the *Philadelphia Heating and Plumbing Contractors Association,* the *United Association of Journeymen Plumbers and Steamfitters,* and Harmony Lodge No. 52, as well as by his social and business friends.

The Officers and Council feel that a distinct loss has been caused by his passing and extend their sincere sympathy to his four daughters and two sons, who survive, his wife having passed away five months previous to his death.

Death of B. E. Haskell

The Society has received word recently of the death on December 27, 1932 of Benjamin E. Haskell, an esteemed and popular member, who resided in Woodfords, Maine.

Mr. Haskell was born on December 14, 1889 at Westbrook, Maine, and, after receiving his academic education in the public schools, was graduated from the University of Maine in 1912 with the degree of B.S. in Electrical Engineering.

For five years following graduation he was associated with the General Electric Co. at Lynn, Mass., attending the student engineering course for two years and later became interested in the design of steam turbines. From 1917-1919 he was with E. S. Lincoln, Inc., of Portland, Maine, serving as electrical engineer engaged in meter and power plant testing.

In 1919 he joined the Fels Co., Portland, with whom he was associated at the time of his death, as engineer employed in the design of heating and ventilating plants and the field supervision of their construction.

Mr. Haskell was greatly interested in music. He was an accomplished violinist and was president of the Portland Symphony Orchestra. He is survived by his widow and three sons, to whom the Officers and Council extend their heartfelt sympathy.

Death of William A. Pope

The AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS regretfully records the passing of William A. Pope, a member of the Society since 1906 and one of the oldest members of the Illinois Chapter, who died at Palm Springs, Calif., on Friday, February 17.

Mr. Pope was president of the William A. Pope Co., heating and power plant contractors, with offices at 26 N. Jefferson St., Chicago. He was born on May 8, 1867 at Chicago and attended the public grammar and high schools. His early experience was obtained while with Samuel I. Pope Co. from 1885 to 1900, after which he entered the contracting business under his own name.

Mr. Pope was also a member of the *Heating and Piping Contractors National Association* and served as a member of the Conference Committee on Labor from 1923-1925.

Surviving Mr. Pope are his widow, Laura Daniels Pope, a daughter, Elizabeth Pope Doree, and a son, S. Austin Pope, to whom the Officers and Council join in extending their sincere sympathy.

Funeral services were held on Thursday, at 2:00 p. m., from his residence at 612 Keystone Ave., River Forest, with interment at Libertyville, Ill.

CANDIDATES FOR MEMBERSHIP

The Constitution of the Society as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society or sent to the members in other approved manner as ordered by the Council. When replies are received from references, the Candidate's application shall be submitted to and acted upon by the Membership Committee as soon as possible.

When the Membership Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 74 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Membership Committee, and in turn the Council, urge the members to assume their share of the responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some members by March 15, 1933, these candidates will be balloted upon by the Council. Those **elected to membership will be notified by the Secretary immediately after election.**

CANDIDATES	REFERENCES	
	Proposers	*Seconders*
ANKER, GEORGE W., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
BARBIERI, PATRICK J., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
BIRUKOFF, ROMAN R., Student, New York University, New York, N. Y.	H. Maiman A. Raffes	R. D. Morrill
BREITENBACH, GEORGE C., E. J. Febrey & Co., Washington, D. C. (*Advancement*)	E. J. Febrey M. W. Miller	T. H. Urdahl G. L. Larson
BREWER, JOHN G., Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	F. C. Houghten
BROWN, RONALD FRANCIS, Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
BURNS, JOHN R., Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
COHEN, NATHAN, Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
COPPERUD, EDMUND R., Minneapolis Plbg. Co., Minneapolis, Minn.	G. A. Dahlstrom A. B. Algren	Albert Buenger E. F. Jones
DAVENPORT, R. F., Furnace Sales Mgr., Canada Foundries & Forgings, Ltd., Brockville, Ont., Canada.	R. J. Millar J. S. Wood	J. S. Paterson W. R. Blackhall
DEUTCHMAN, JULIUS, Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
DICE, EUGENE S., Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
DURYEA, ALBERT A., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare R. D. Morrill
EISS, ROBERT M., Mfrs. Repr., Bell & Eiss, Inc., Minneapolis, Minn. (*Advancement*)	C. E. Lewis Albert Buenger	A. B. Algren E. F. Jones
EMERY, HUGH, Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare

CANDIDATES	REFERENCES	
	Proposers	*Seconders*
Fegley, Donald R., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Ferrero, Henry J., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Flarsheim, Clarence A., Frigidaire Sales Corp., Kansas City, Mo.	J. B. Fehlig Carl Clegg	C. A. Weiss F. A. Sheppard
Friedman, Milton, Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Fritz, Charles V., Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
Gautesen, Alf, Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Genchi, Bernard, Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Giannini, Albert A., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Gilling, William F., Asst. Mgr., American Radiator Co., Boston, Mass. (*Advancement*)	W. T. Jones D. S. Boyden	Alfred Kellogg
Godfrey, Paul S., Mgr., Iron Fireman of Milwaukee, Inc., Milwaukee, Wis.	C. H. Randolph J. H. Volk	Ernest Szekely J. S. Jung
Haigney, John E., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Hamburger, Fred G., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Hanley, Edward V., Pres., S. V. Hanley Co., Milwaukee, Wis.	C. H. Randolph M. Erickson	Ernest Szekely F. G. Weimer
Ingold, John W., Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	J. L. Blackshaw T. F. Rockwell	C. M. Humphreys
Jacobson, Ruben A., Graduate Student, University of Minnesota, Minneapolis, Minn.	F. B. Rowley A. B. Algren	Albert Buenger E. F. Jones
Jalonack, Irwin G., A. L. Hart, Patchogue, L. I., N. Y. (*Advancement*)		
Jordan, Richard C., Graduate Student, University of Minnesota, Minneapolis, Minn.	F. B. Rowley A. B. Algren	Albert Buenger E. F. Jones
Karges, Louis, Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
Kastner, George C., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Kaufman, William M., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Kellner, Day C., Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
Kennedy, Owen A., Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
Kenward, Stanley B., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Kroupsky, Vladimir, Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Kuehn, Walter C., Kuehn Htg. & Vtg. Co., Minneapolis, Minn.	J. E. Swenson L. H. Johnson	F. B. Rowley A. B. Algren
Leffingwell, Robert R., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Lofe, John A., Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
Lowy, M. R., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
Lund, Clarence Edward, Student, University of Minnesota, Minneapolis, Minn.	F. B. Rowley W. F. Uhl	A. B. Algren Albert Buenger
Mathis, V. J., Student, Carnegie Institute of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
Matullo, Joseph R., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
McLarney, Harry W., Sales Engr., Union Electric Light & Power Co., St. Louis, Mo.	C. A. Pickett J. W. Cooper	C. R. Davis E. E. Carlson
Monroe, Meade, Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare

CANDIDATES	REFERENCES	
	Proposers	*Seconders*
MOREHOUSE, H. PRESTON, Gen. Air Cond. Repr., Public Service Elec. & Gas. Co., Newark, N. J.	H. W. Fiedler L. T. M. Ralston	S. A. S. Patorno H. L. Alt
NEARY, DANIEL A., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
NEEDLER, J. H., Engr., Phillips Getschow Co., Chicago, Ill.	John Howatt R. M. Getschow	W. J. Mauer A. B. Martin
OPPERMAN, EVERETT F., Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
OSBURN, RICHARD M., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
PENNEL, REED, Sales Repr., Buckeye Blower Co., Pittsburgh, Pa.	C. C. Choffin F. C. McIntosh	E. C. Evans G. S. McEllroy
PERINA, ARTHUR E., Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
PISON, DONATO, JR., Student, New York University, New York, N. Y.	H. Maiman A. Raffes	R. D. Morrill
POWELL, KNOX A., Graduate Student, University of Minnesota, Minneapolis, Minn.	F. B. Rowley A. B. Algren	Albert Buenger E. F. Jones
QUEER, ELMER ROY, Instr. in Engrg. Research, Penn. State College, State College, Pa.	L. A. Harding F. B. Rowley	F. C. Houghten C. H. B. Hotchkiss
RIDDLE, KEMBLE L., Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
ROCKWELL, THEODORE F., Instr. in Htg. & Vtg., Carnegie Inst. of Technology, Pittsburgh, Pa. (*Advancement*)	C. M. Humphreys J. L. Blackshaw	F. C. Houghten G. S. McEllroy
SCHLOSSMAN, MELVIN B., Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
SHERMAN, RALPH A., Fuel Engr., Battelle Memorial Inst., Columbus, O.	L. E. Seeley Margaret Ingels	F. C. Houghten Percy Nicholls
SIMKIN, MILTON, Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
SMITH, ROBERT HUGH, Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw
STACK, FRANK C., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
STEVENS, JOHN M., Plbg. & Htg. Contractor, Philadelphia, Pa.	H. H. Erickson H. J. Faltenbacher	A. A. Miller E. N. Sanbern
STITT, ARTHUR B., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
TRIMMER, CHARLES M., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
TURNAU, EDMUND H., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	R. D. Morrill
VERNIER, MARCEL G., Student, New York University, New York, N. Y.	A. Raffes H. Maiman	G. O'Hare
VOGT, JOSEPH B., Htg. Engr., N. Y. State Dept. of Public Works, Albany, N. Y. (*Advancement*)	G. H. Giguere L. L. Smith	L. E. Rollins H. C. Kappler
WIGGINS, O. J., Graduate Student, University of Minnesota, Minneapolis, Minn.	F. B. Rowley A. B. Algren	W. F. Uhl C. E. Lewis
WILKINSON, FARLEY JAMES, Engr., Montgomery Ward & Co., Chicago, Ill.	Bert Bernstrom E. M. Mittendorff	J. H. Van Alsburg G. A. Voorhees
WRIGHT, CLARENCE E., Student, Carnegie Inst. of Technology, Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	J. L. Blackshaw

Candidates Elected

In past issues of the JOURNAL of the Society the names of the following men were listed as Candidates for Membership. The membership grade of each Candidate has been assigned by the Membership Committee and balloted upon by the Council. We are now instructed by the Council to post herewith, as required by Art. II, Sec. VIII, of the By-Laws, the following list of candidates elected:

MEMBERS

MCLENEGAN, DAVID W., Asst. Engr., Comm. Engrg. Div., Air Cond. Dept., General Electric Co., Schenectady, N. Y.

OLCHOFF, MAURICE, Olchoff Engrg. Co., Kansas City, Mo.

RICHARD, EDWIN J., Edwin J. Richard Equipment Co., Cincinnati, O.

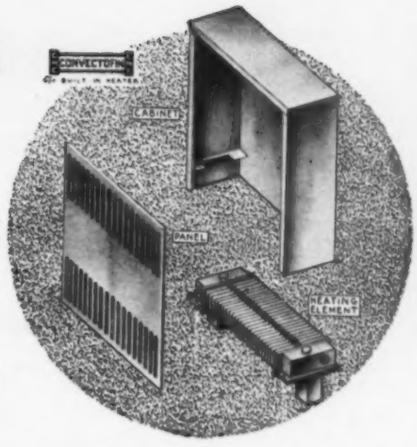
STUDENTS

ARCHDEACON, HOWARD K., Student, New York University, New York, N. Y.

NOBLE, THEODORE G., Graduate Student, University of Minnesota, Minneapolis, Minn.

THE *FIRST* BUILT-IN HEATER TO GIVE

CERTIFIED PERFORMANCE



No More Worry About Heating Capacity!

For the first time information is made available to the heating industry in the form of *positive certified performance.* The information is new and useful. It explains the behavior of convection heaters; gives facts and figures on heating effect and tells what the actual steam consumption is for the different sizes of Convectofin heaters.

Ratings in complete accord with the Principles of the
AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

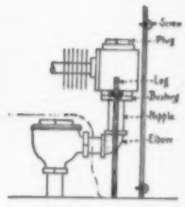
CONVECTOFIN, which "Takes the Place of Radiators," embodies fifteen years of manufacturing skill with finned tubing.

At the top we show a sketch of Convectofin The Built-In Heater which replaces radiators in modern room heating. Assures improved temperature distribution. Air is heated and circulated naturally—by convection—NOT by radiation. Consists of a copper fin-and-tube heating element supported on brackets, within a furniture steel cabinet having an air inlet and outlet. Warm air is projected horizontally through the outlet grille directly into the living zone of the room, where the heat is most needed.

Meets, in every way, the selection requirements of the
HEATING AND PIPING CONTRACTORS NATIONAL ASSOCIATION

Convectofin delivers heat quickly, evenly and noiselessly, with less fuel consumption. It occupies less space and weighs less. It permits freedom in room treatment to harmonize with any decorative scheme. No dirty streaks on walls and ceilings—less cleaning, painting and redecorating.

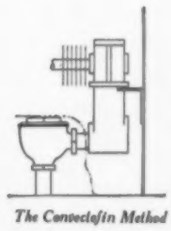
Standard cabinets are available to fit every need such as flush type installation, offset type, floor cabinet, wall cabinet, and concealed type. Other combinations for special conditions are readily practicable due to the flexibility of Convectofin. In place of the inlet and outlet grilles shown, a cut-out inlet may be used with an outlet grille in any standard arrangement. The position of the heating element permits making all piping connections under it, but inside the cabinet, saving space, labor and material and simplifying the installation, as illustrated at the right.



Ordinary Method.

Unbiased investigations and proof by
THE FROST RESEARCH LABORATORY

have been completed. Heating and Ventilating Engineers are not asked to rely on OUR tests because of the possibility that we, as manufacturers, might be prejudiced in favor of our own product. That is why we went to Frost who operates a complete independent organization, favorably and widely accepted for accuracy, methods, and equipment, in testing work for the heating field. Ask for "Certified Performance."



The Convectofin Method

With Convectofin the Heating and Ventilating Engineer is relieved of heating worries, the builder avoids job difficulties, the steamfitter cuts labor and material costs, while the owner gets 100% heating results with the least expense for fuel and maintenance. What are your requirements? Write a letter, or, use the coupon below.

COMMODORE HEATERS CORPORATION

11 WEST 42nd STREET NEW YORK, N. Y.

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The BUILT-IN HEATER

AGENTS WANTED

for some territories still open. Applications from high-grade manufacturers' representatives who regularly handle heating trades accounts will be considered.

Fill in, Clip, and Mail

Commodore Heaters Corp., 11 West 42nd St., New York City
Without the slightest obligation please

- ☐ Send treatise, "How to Obtain Comfortable Economical Heating."
- ☐ Send Convectofin Bulletin No. 5.
- ☐ Send Data on "Certified Performance."
- ☐ Send representative.

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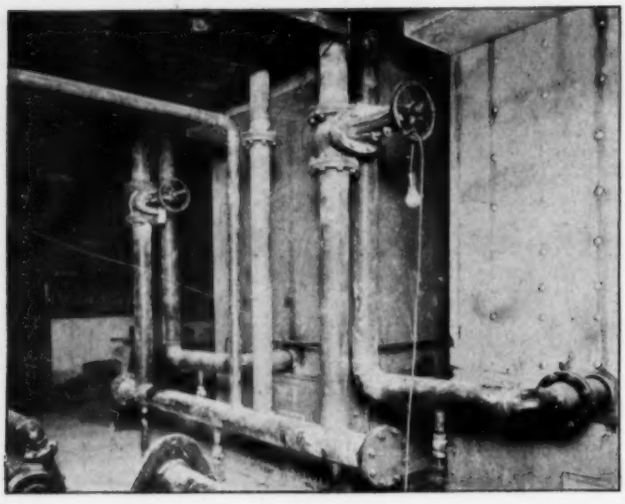
Firm .....

Street ..... City ..... State .....

BYERS WROUGHT IRON

Make the Job 100%!
Byers Pipe PLUS
Taylor Forge Elbows



THE all-welded piping system in which genuine wrought iron elbows made by Taylor Forge & Pipe Works are specified with Byers Pipe is a *balanced system.*

Byers Genuine Wrought Iron Pipe has been a standard of wrought iron quality for sixty-nine years. Hence, Taylor Wrought Iron Elbows forged from Byers Pipe combine the lasting qualities of wrought iron with the most modern engineering design known in the art of welding.

BYERS GENUINE WROUGHT IRON PRODUCTS

A. M. BYERS COMPANY
Pittsburgh, Pa. · Established 1864

(*From page 141, Editorial Section*)

nected for hand switch use. The value of the choice of speeds is in that each unit is thereby capable of being finely adjusted as to capacity to fit the conditions of the particular location. This adjustment was made when the job was put into operation which accounts in part, at least, for the fact that the job was almost perfectly balanced.

Automatic control is provided for starting and stopping the compressors to maintain a predetermined fluid temperature in the coolers. It is practical for the operating engineer to set this to conform with major changes in the outside weather conditions.

The control of temperatures to a finer point than is obtained by varying the fluid temperature is had by just as simple a process as the occupants of the various departments have been accustomed to for years—namely, turning on or off or changing the speed of fans.

Table Shows Excellent Results

Just how well the desired conditions may be maintained is demonstrated by the record of temperatures in Table 1. At the time the 3-p.m. readings were taken almost the exact maximum conditions existed as those for which the system was designed. Under these conditions the expected inside conditions were surpassed in every individual room and also for the average of all departments.

It is interesting to compare the results in these various departments having such varied occupancies, exposures, etc., with the comfort chart shown in Fig. 13. It will be noted that this comparison shows an average was maintained of 84.8 per cent of theoretical perfection in human comfort.

335 Hp Is Motor Load for Refrigeration

The rated capacity of the refrigeration plant is 230 tons per 24 hr with a connected motor load of 335 hp or 1.46 hp per ton of refrigeration. During the foregoing test conditions somewhat less than 80 per cent of the total motor-hp load was being consumed.

From the schematic diagram previously referred to it will be seen that heating may be accomplished as an adjunct to this type of cooling and dehumidifying system by the simple addition of a steam heat-exchanger. Because the size or capacity of the units is necessarily greater for cooling than would be required if installed primarily for heating, the fluid temperatures required to maintain comfortable conditions in winter would be relatively low, not more than 150-F average if zero weather were to be encountered. This makes for a desirable type of heating equipment in that outlet air temperatures from the units would under maximum conditions be only approximately 100 F.

Conclusions

The installation and operation of this unit-type cooling and dehumidifying system have proved it to be:

Practical in its applicability from a structural standpoint.
Practical to operate and yet resulting in a high percentage of human comfort.
Economical in first cost.
Economical in operation.

Recent Trade Literature

Air Conditioning: Clarage Fan Company, Kalamazoo, Mich. 12-p. reprint of article on the air conditioning of the 20-story Mutual Home Building, Dayton, Ohio. Cold water is supplied from deep wells; steam is supplied from utility. Information on cost of operation included.

Draft Regulators: Carrick Engineering Co., Michigan City, Ind. 8-p. booklet on preventing fuel loss in high buildings with draft regulation, discussing the problem and describing regulation equipment. Also 12-p. booklet describing a furnace draft regulator and fuel economy in industrial plants.

Heating Specialties: The McAlear Mfg. Co., Chicago, Ill. 24-p. technical bulletin describing vapor- and vacuum heating specialties, including radiator valves and traps, automatic air valves, air eliminators and return traps, high-pressure thermostatic steam traps, low-pressure traps, damper regulators and gage, pressure-reducing regulators, and water feeders and controllers. Four pages of engineering data and several application drawings are included.

Instruments: Bacharach Industrial Instrument Company, 7000 Bennett St., Pittsburgh, Pa. Looseleaf booklet describing and illustrating two types of direct-reading single-tube vertical manometers and an inclined-tube manometer. Instruments are available for measuring pressure, suction or differential pressure over various ranges up to 160 in. of water, 80 in. of mercury, or 40 lb per sq in.

Mechanical Rubber Goods: The Diamond Rubber Company, Inc., Akron, Ohio. 24-p. catalog of rubber goods for industrial uses, including rubber belts, hose, tubing, packing, chute linings, pump valves, matting, cements, sponge rubber, etc. including engineering data and information on ordering.

Motors: General Electric Company, Schenectady, N. Y. Data sheet for totally-enclosed squirrel-cage motors, ½ to 2 hp; available in standard, weather-proof, explosion-proof and dust-tight constructions.

Pipe: Republic Steel Corporation, Youngstown, Ohio. 6-p. folder describing and giving dimensions of electric weld drive pipe and casing for water wells.

Stainless Steel: Republic Steel Corporation, Youngstown, Ohio. 16-p. booklet on architectural uses of stainless steel, including information on types, finishes, fabrication data, and installation methods.

Temperature Regulators: Atlas Valve Co., Newark, N. J. 12-p. temperature regulator data and price book on self-contained vapor-type regulators for liquids. Applications to fuel oil control, desuperheating, and controlling the temperature of liquids under various conditions are illustrated.

Turbines: General Electric Company, Schenectady, N. Y. 4-p. bulletin describing two- and three-stage turbines (90 to 500 hp) for mechanical drive of pumps, fans, compressors, pulverizers and similar apparatus, and supplying low-pressure steam for process or heating.

Water Feeders: The McAlear Mfg. Co., Chicago, Ill. 24-p. booklet describing simplex and duplex boiler water feeders, controllers, cut-out switches, liquid-level controllers, feed water regulators, etc., including application drawings and a discussion of automatic water feeding.

Welded Piping: Air Reduction Sales Co., New York City. 24-p. booklet, well illustrated, on welding piping for heating systems, including information and illustrations on welding methods, fittings, equipment, etc. A typical welded piping job for a hospital is described and pictured briefly.

Welding: Harnischfeger Corporation, Milwaukee, Wis. 20 p. bulletin devoted to electric welding, describing the features of electric welders and illustrating the welders and their applications.

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INDUSTRIAL, COMMERCIAL AND MARINE REFRIGERATION » OIL REFINERY EQUIPMENT
MILK AND ICE CREAM PLANT MACHINERY

(*From page 144, Editorial Section*)

problem was handled in a different way. (See Fig. 2.) The rooms are heated by steam radiators and the temerature in each room is controlled by its own thermostat acting on the radiators. An oil-fired auxiliary steam boiler was provided. As the pressure in the steam main from the central plant varies considerably at different seasons, it was impossible to use the varia-

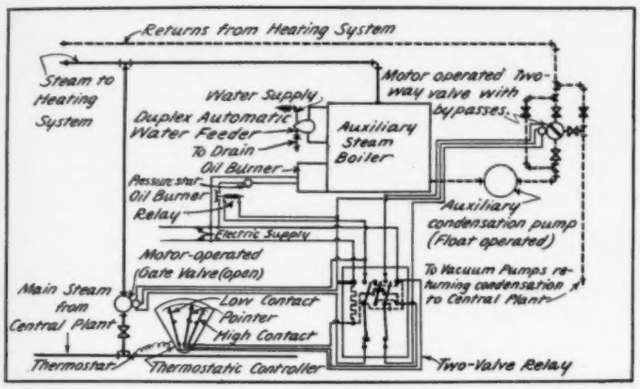

Fig. 2—A similar problem solved in a different way. On this job an oil-fired auxiliary steam boiler generates steam for heating laboratories in a building when the central plant supplying steam for heating the entire building is shut down at night

tion of pressure as a means of control. Therefore, an electric temperature controller was attached to the steam main from the central plant and set so that a drop of a few degrees in the temperature of the steam causes the oil burner to start; at the same time a valve on the outside steam main is closed and a three-way valve on the return is opened so that the returns run to the receiver of a condensation pump which discharges them back into the oil-fired boiler. The boiler also has an automatic water feeder for emergency. The burner is automatically controlled by a pressurestat set to keep the pressure in the boiler at one pound. Under this operating condition all steam is supplied by the auxiliary boiler as a separate system and the room thermostats operate on the radiator valves in the normal manner.

When steam is again turned on the mains at the central plant, the temperature of the steam main acts on the temperature controller to shut off the oil burner, open the valve on the steam main and that on the return so that the system is connected to the central-plant system and the auxiliary boiler is cut off. To prevent the auxiliary boiler from getting too cold during its idle period (which would delay the delivery of steam to the radiators) the steam main from the central plant is connected to the boiler; sufficient steam flows through this to keep the water in the boiler hot.

In the article "Mile-Long Underground Line Supplies Steam for Process" in the March, 1932, issue the following statement appears: "The total volume of the line will be about 2,000 cu ft and it will contain under normal pressure conditions about 2,400 lb of steam. The line itself will act as an accumulator or surge tank and will smooth out any sudden fluctuation in load."

The figure "2,000 cu ft" is incorrect; it should be 4,720 cu ft.

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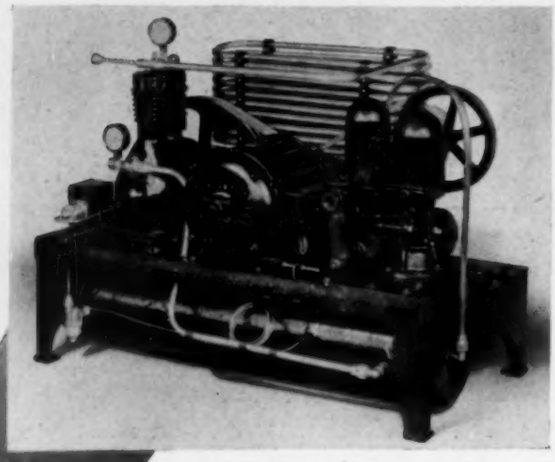

Repulsion-Induction

Split-Phase

Capacitor

Direct-Current

Squirrel-Cage

Fynn-Weichsel Synchronous

THE motor operating the cooling unit of an air conditioning system illustrated above, is a Wagner repulsion-start-induction.

Other types of motors Wagner builds for air conditioning machinery are: split-phase (primarily for small blowers and pumps), capacitor, squirrel-cage (3-phase and 2-phase), direct-current—and, on large jobs, the powerfactor-correcting Fynn-Weichsel synchronous motor.

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☐ Repulsion-induction ☐ Split-Phase ☐ Capacitor ☐ Squirrel-Cage ☐ Fynn-Weichsel

(*From page* 146, *Editorial Section*)

Manner of Tack-Welding Important

The manner in which the several parts are tack-welded in position after they are aligned, has been proved to be the secret of making a pipe weld or pipe-to-fitting weld without distortion. A pipe or fitting tacked or spot welded lightly can not maintain alignment under the stresses set up by draw, distortion or warping caused by the contracting forces created by a weld which has cooled unevenly. If an assembly of parts is rigidly tack-welded in a sufficient number of places—dependent upon the length of the weld—no deflection need generally be experienced.

Welding a Valve and Fitting Assembly

A practice seldom recommended (although treated in the article) is to assemble a group of parts consisting of fittings, flanges, valves, etc., tacked into position and later welded. Such a procedure often requires subsequent expensive field changes unless a study is made of the comparative draw and shrinkage in the welds. Following the welding of parts we may expect a shrinkage in length varying from 1/32 to 1/16 in. for each weld. Throughout the length of a line, such added shrinkages seldom cause unfavorable dimensional tolerances, but where valve and by-pass assemblies are made, it may be noticeable and objectionable.

For example, consider an assembly consisting of a pressure-reducing valve bolted to a flanged gate valve on each side; the outside flange of each gate valve is bolted to a high-hub welding flange which with a short piece of pipe extends to a welding tee, from which the bypass is branched on each side of the valve assembly. The by-pass valve is flanged and bolted to a high-hub flange, which in turn extends with a short length of pipe to a welding elbow, and thence to the branch of the welding tee. From each gate valve to the branch of the tee, there are two welded joints and likewise from the bypass valve to the welding elbow there are also two welded joints. The evened shrinkage of welded joints in such an assembly would cause no undue strain.

Suppose however that no welding tees were used and that the branch was pipe-to-pipe. This would cause the collected assembly to be unevenly strained by this variation in shrinkage, thus creating a strain upon the flanged joints of the bypass valve, and possibly a leaky joint. Before placing in service, the assembly would doubtless have to be unbolted and rechecked for alignment of flange faces. In the event that the design called for one or more short nipples in between the valves, another shrinkage condition would be created in the reverse direction possibly, but always one to consider seriously.

Undoubtedly the best practice is to fabricate the two parts separately, and to provide in one of the parts a provision for field cutting and welding to the desired length. In the example given, this would properly be at one of the horizontal runs from a welding elbow at either side of the by-pass. Not only does this procedure permit ground or shop welding with field erection of parts, but an essential field fitting which is necessary to maintain the reputation for the welded installation.

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It explains how temperatures can be regulated mechanically, instead of wasting time of men to operate hand valves. It tells how to eliminate the danger of damage to costly materials by too much or too little heat. It explains how to save the cost of installing additional pipe lines to operate temperature controllers that require compressed air or water pressure for their operation. And it gives much other interesting information on the question of temperature control.

Many illustrations are shown of methods of installing temperature regulators, as well as tables that will be found useful. Various types of Sarco Temperature Regulators are shown for controlling the temperatures of hot water heaters, evaporators, retorts, stack or blast heaters, air ducts, preheaters, ovens, kilns, cold storage rooms, etc.

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Chicago Detroit New York Philadelphia

(*From page* 148, *Editorial Section*)

is divided between so-called *low-temperature* and *high-temperature* refrigeration. Yeast, various ingredients and milks require temperatures which are not economically in the range of ejector refrigeration. Fermentation and loaf cooling might well come within the uses of this method, but it would hardly pay the average size bakery to put in some ejector refrigeration and some compression refrigeration, because the cost of the small low-temperature unit for those parts requiring low temperatures would be almost as much as the slightly larger size unit required for the entire bakery. In the second place, many bakeries which formerly used high-pressure steam for their processing now use pressures below 15 lb.

Has Modernization Possibilities

It has been mentioned that steam-ejector refrigeration had and still has a wide use in the oil fields. This is because there is a satisfactory heat balance between the steam generated, the flow temperatures of the oils in their processing, and the condensing medium. In many other chemical fields, and in many industrial fields, where large quantities of refrigeration distributed over a wide area with temperatures that can satisfactorily be obtained with 50 F water are required, and where the condensing medium is cheap, this type of refrigeration may be a boon to the manufacturer. The opportunities for economy with this type of refrigeration open not only a replacement field—which many of us count on today in our hopes for a revival of business—but an expansion into established fields that need cold water for improving processes or for air conditioning.

Storing Cold Water May Improve Boiler Load

An economic phase of this situation not mentioned as yet shows an economy in industrial plant operation that will bear careful investigation. This is not exclusively a steam-ejector problem. It is the installation of a particular size of equipment to utilize the spare steam or electricity at those periods when the plant is not calling for maximum capacity. Steam-ejector equipment, supplemented with capacity for storing cold water, might give an economy either in operation or in first cost that would well justify its investigation.

To give a specific example, assume that 1,000-hp in boiler load is required in a plant for a period of 10 hours, and that 1,000-hp is approximately the most economical operation of the boiler plant. If at the time the 1,000-hp is being used, the demand from the ejector refrigeration were 500-hp, it might be uneconomical to add additional load to the boilers or install new boilers, but if, when the ordinary demand was passed, the refrigeration in the form of cold water could be developed and stored in tanks, it could be used when required. The loss from radiation, convection, etc. would be made up by a partial use of refrigeration during the peak periods. This method would also allow of a smaller installation, as it could work over a longer period, and would increase the efficiency of the boilers during the period in which they had no load to carry.

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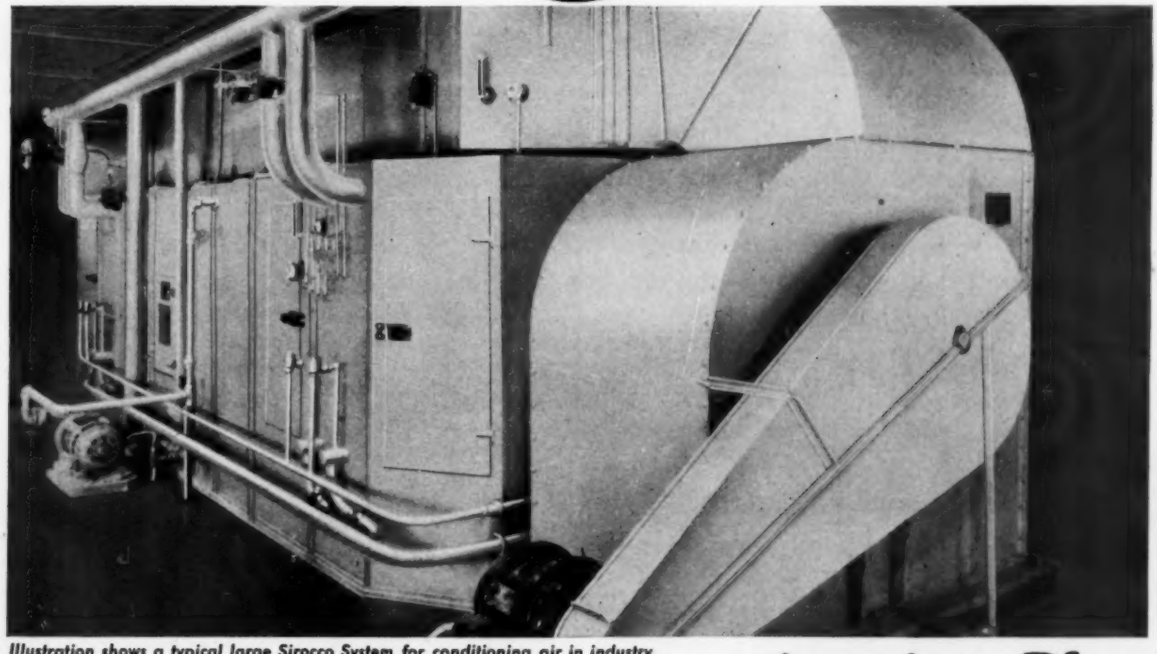

Illustration shows a typical large Sirocco System for conditioning air in industry.

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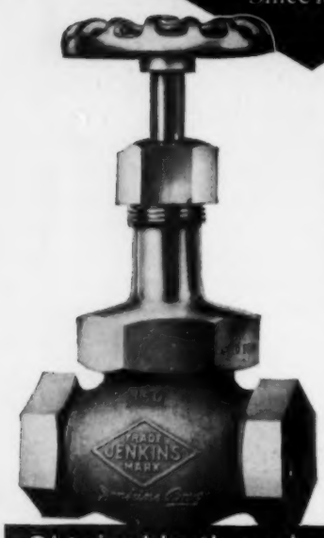

THERE is QUALITY in Fig. 106-A Jenkins Bronze Globe Valve—extra deep stuffing box—slip-on, stay-on disc holder — one-piece screw-over bonnet—Jenkins disc. It pays to insist on Jenkins Valves and the extra service that has characterized Jenkins quality since 1864.

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Fig. 106-A Globe, Screwed

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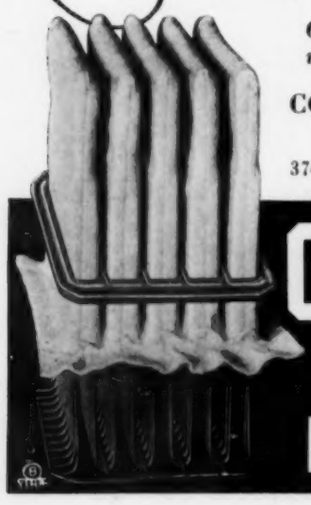

PATENTED COPPUS ANNIS AIR FILTERS

(*From page* 143, *Editorial Section*)

other trouble that might be attributed to undue expansion or unsatisfactory supports. Therefore it appears that the actual movement of the piping checked very closely the design calculations. Furthermore, from the results obtained, the extra cost involved is justified in designing the pipe supports for the service intended, rather than for the dead weight of the pipe.

Anti-Vibration Support for Boiler Feed Piping

In this same plant it was found that considerable vibration existed in the boiler feed piping, due to certain auxiliary equipment not being properly adjusted. While it was felt this could be remedied, it was deemed advisable to have the pipe supports so designed that the worst condition of vibration would be taken care of by the supporting structures.

In considering the design of the supports, it was apparent that the pipe should be firmly held so as to reduce vibration and at the same time permit pipe to expand

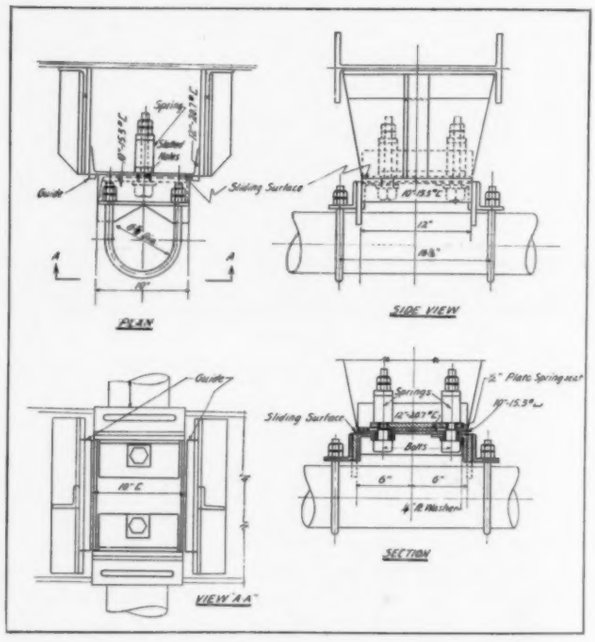

Fig. 3—Support designed to prevent vibration in piping

in the proper plane. Fig. 3 shows the support as redesigned for use on a 6-in. vertical line.

It will be seen that the pipe is bolted to a saddle made up of structural steel members welded to a 10-in. channel iron, and that the saddle is held by springs between guides on a 12-in. similarly-shaped member.

To provide for movement of the pipe in the vertical plane, the bolt holes through the 10-in. channel were slotted. In assembling, these springs were compressed thus introducing additional friction on the sliding face of the saddle sufficient to dampen the vibration but not enough to prevent the movement of the pipe in the vertical plane due to expansion. Indications are to date that this type of support has been successful in dampening the vibration and yet has permitted free movement of the pipe due to expansion.

(*From page 150, Editorial Section*)

Bad threads are usually due to the threading devices not being in good condition, improperly adjusted or the use of dies and chasers that are not ground correctly for the metal to be threaded.

The metal of which the pipe is made should be taken into consideration, as the design of the threading chasers, grinding and sharpening, has everything to do with getting a successful threading operation.

The angle at which the cutting edges of the thread chasers strike the pipe is the *lip angle,* sometimes called the *rake*. The lip angle is gaged by the cutting edge and face of the chasers together with a vertical line passing through the point of contact of the cutting edge of the chaser with the pipe. The position of the chaser, in reference to the center line of the pipe should be taken into consideration.

The purpose of the lip angle is to incline the cutting face of the chasers to remove the surplus metal properly with a clean cut and clear away the chips. The proper lip angle depends on the metal to be threaded. The chasers should be ground so as to make a neat cut, with a long chip which will naturally curl into a spiral shape. When the chips are small and broken, it indicates that the chaser is dragging through the metal; a broken or torn thread will be the result. Wrought-iron usually requires a lip angle of about 15 or 16 degrees. For some grades of steel pipe 16 to 20 degrees is sufficient. For some of the grades of seamless steel pipe, the lip angle may be as great as 30 degrees.

Space should be provided for the chips to clear and not get lodged in the chasers. An excess amount of chips packed in the chasers during the thread cutting operation is the cause of many broken threads. A free flow of thread-cutting oil will assist in keeping the chaser teeth free of chips. With die-holders of the expanding type, the chasers can be brought clear of the pipe when threading is completed. It is not necessary to back the pipe out of the chasers and run the risk of chips spoiling the threads.

Broken teeth in the chasers do no threading and cause only trouble. The best practice is to grind them out, which requires the use of a thin grinding wheel to do the work without touching the adjacent teeth.

The *heel* or back of the chasers should be ground so as to allow a small amount of clearance. On the other hand too much clearance takes away the steadying effect and results in imperfect threads.

The *lead* is the front end of the chasers where they first engage the pipe. A good beginning is essential in any operation and this holds good for the thread chasers. The chasers are ground to a bevel so that the end of the pipe enters and completes the centering. It is not correct to have too much bevel or taper to start the threading. The cutting away of the end of the pipe to start the thread should be done in the same regular manner as the rest of the threading, each chaser doing its share to prepare for the starting of the thread. Too long a bevel will cause the chasers to feed too fast. When regrinding the chasers for lead, look for the starting thread and arrange the chasers in regular order before commencing the grinding.

Careful attention should be given to the lip, clearance, lead and chip space of pipe-threading chasers. Proper

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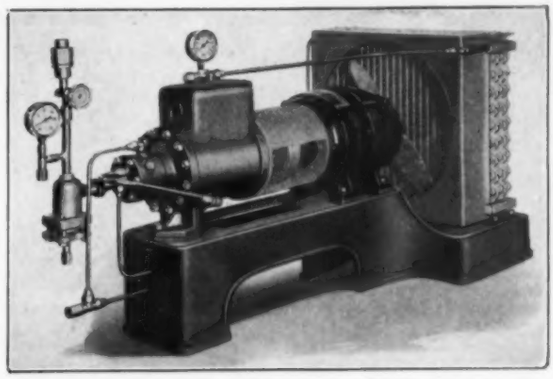

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FOR ALL BITUMINOUS COALS

grinding will take care of many difficulties in pipe threading. A suitable grinding wheel with a stationary and adjustable rest is required. If the proper equipment and experience are not available it is better to send the chasers to a manufacturer of threading equipment, together with a few short pieces of the pipe to be threaded, for advice.

Grinding chasers is a careful operation. It is not difficult but requires some practice and suitable equipment. It is an easy matter to spoil a set by improper grinding.

Close attention should be given to the die-holder, to see that the interior openings for the chasers are free from all traces of chips and cuttings. It is common practice to loosen the screws in the face plate and remove the chasers, with a minimum amount of cleaning in removing the fine chips, when changing for the different pipe sizes. It does not take much longer to remove the face-plate ring and clear the openings of all of the fine cuttings that lodge in the interior space. If this is not done each time, the face ring should—at the least—be removed frequently and the die-holder cleaned thoroughly. A small jet of compressed air will do the work in a few minutes.

Care should be taken to see that the alignment of the pipe in the pipe-threading machine is correct and that the die-head is in proper alignment with the gripping chuck.

New Book on Arc Welding

Cutting costs by redesigning is the theme of "Designing for Arc Welding" just published by The Lincoln Electric Co., Cleveland, Ohio, and containing prize-winning papers submitted in the recent competition sponsored by that concern. The published papers are those judged the best from some 400 submitted in the competition and include the work of foremost engineers in the United States and abroad.

The book consists of approximately 450 pages bound in cloth-covered boards and costs $2.50; it is divided into five sections: Machinery; Shipbuilding; Buildings and Bridges; Large Containers; and Piping and Fittings. In every case, the fundamentals of the design are so explained as to make them applicable to other industries.

One of the principal points on which the papers in the competition were judged was the possible savings in costs with arc welding. Each paper gives actual costs and shows how the savings were made.

Among the contributors are Lt. Com. Homer N. Wallin and Lt. Henry A. Schade, U. S. N., winners of the first prize; H. H. Tracy, structural engineer, Southern Calif. Edison Co.; Major G. M. Barnes, ordnance dept., U. S. A.; H. J. L. Bruff, London and North Eastern Ry., London, England; William H. Zorn, The Detroit Edison Company; Raymond Hoffman, The Standard Oil Co. of New Jersey; Gustav Wahl, chief naval architect, Deutsche Werke Kiel, Kiel, Germany; K. T. Sorenson, designing engineer, Baldwin Southwark Corp., and many others. The editor is A. F. Davis.

Conventions and Expositions

American Society for Testing Materials: New York regional meeting, March 8; group meetings of committees, March 6-10, New York City. Annual Meeting, June 26-30, Hotel Stevens, Chicago. Secretary, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Forced Warm-Air Short Course: March 28-30, Michigan State College, East Lansing, Mich. (Dean Dirks or Professor Miller).

American Oil Burner Association: Annual convention, June 12-16, Hotel Stevens, Chicago, Ill. Secretary, H. F. Tapp, 342 Madison Ave., New York City.

Midwest Engineering and Power Exposition: June 25-30, Coliseum, Chicago. Headquarters, 308 W. Washington St., Chicago.

National District Heating Association: Annual convention, June 26-28, Hotel Sherman, Chicago. Secretary, D. L. Gaskill, 603 Broadway, Greenville, Ohio.

Heating and Piping Contractors National Association: Annual convention, July 25-28, Chicago. Secretary, J. C. Fitts, 50 Union Square, New York City.

American Gas Association: Annual convention, September 25-29, Chicago. Headquarters Office, 420 Lexington Ave., New York City.

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